Series 1959, No. 33

Issued January 1964

SOIL SURVEY

Caroline County Maryland

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
MARYLAND AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of Caroline County will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, drainage and irrigation systems, and other structures; aid foresters in managing woodlands; aid in community and county planning and development; and add to our knowledge of soils.

Locating the soils

Use the index to map sheets at the back of this report to locate areas on the detailed soil map. The index is a small map of the county, on which numbered rectangles have been drawn to show what part of the county is represented on each sheet of the detailed soil map. When the correct sheet of the soil map has been found, it will be seen that the soil areas are outlined and that each soil is designated by a symbol. All areas marked with the same symbol are the same kind of soil. Suppose, for example, an area located on the map has the symbol SaB2. The legend for the detailed map shows that this symbol identifies Sassafras loam, 2 to 5 percent slopes, moderately eroded. This soil and all others mapped in the county are described in the section "Descriptions of the Soils."

Finding information

Different sections of this report will be of special interest to different groups of readers.

Farmers and those who work with farmers can learn about the soils in the section "Descriptions of the Soils" and then turn to the section "Use and Management of the Soils." In this way they first identify the soils on their farms and then learn how these soils can be managed and what yields can be expected. The "Guide to Mapping Units," at the back of the report, shows where information about each particular use of the soils can be found in this report.

Foresters and others interested in woodland management can refer to the section "Woodland." In that section, the soils of the county are grouped according to their suitability for trees, and factors affecting the management of woodland are explained.

Sportsmen and others who are interested in improving or extending habitats for game birds, animals, and fish will find useful information in the section "Wildlife."

Engineers can refer to the section "Engineering Uses of the Soils." Tables in that section show soil characteristics that affect engineering.

Community and county planners can use the information in the section "Use of the Soil Survey in Community Planning." They can also find useful information in the section "Engineering Uses of the Soils," particularly in the part dealing with septic tanks.

Soil scientists and others interested in the nature of soils will find information about how the soils were formed and how they are classified in the section "Formation, Morphology, and Classification of the Soils."

Students, teachers, and other users will find various parts of the report useful, depending on their particular interests.

Newcomers to Caroline County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the County," which gives additional information about the county.

* * * * *

The soil survey of Caroline County was made as part of the technical assistance furnished by the Soil Conservation Service to the Caroline Soil Conservation District. Fieldwork for this survey was completed in 1959. Unless otherwise indicated, all statements in the report refer to conditions in the county at that time.

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SOIL SURVEY OF CAROLINE COUNTY, MARYLAND

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UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE MARYLAND AGRICULTURAL EXPERIMENT STATION

CAROLINE COUNTY is in the west-central part of the peninsula known as the Eastern Shore (fig. 1). It is bounded on the north by Queen Annes County, on the west by Queen Annes and Talbot Counties, and on the south by Dorchester County. Sussex County and Kent County, Del., form the eastern boundary.

The total area of Caroline County is 320 square miles, or 204,800 acres. Denton, the county seat, is on the navigable part of the Choptank River and is about 33 miles from the Chesapeake Bay.

Caroline County was established in 1773. Many of the early settlers were of English descent. In 1930 the population of the county was 17,387. It had increased to 19,462 by 1960. Denton had a population of 1,938 in 1960, and Federalsburg had a population of 2,060.

About 193,000 acres, or 95 percent of the land area of the county, is suited to cultivation. About 7,400 acres, or between 3 and 4 percent of the county, consists of soils that are not well suited to cultivated crops but that can be used for forest or, to some extent, for pasture and for growing forage for livestock. Most of the remaining acreage consists of salt marshes that are not suited to agriculture.

Drainage is the most common problem in managing the soils. About 45 percent of the acreage of the county consists of soils that are wet enough to need some artificial drainage before they can be used for agriculture. About one-fourth of this acreage needs simple drainage practices, but three-fourths is wet most of the time and needs intensive drainage. About 18 percent of the county consists of very sandy, droughty soils that are low in natural fertility. About 19 percent needs erosion control measures if cultivated. Only about 17 percent needs no drainage or other special management practices.

The climate in Caroline County is favorable for general farming and for specialized types of farming, such as growing truck crops, strawberries, or blueberries, and raising poultry. Lumber production is not an important industry in the county at the present time. Urban development has not been extensive in the county, but some houses have been built in areas that were once important for agriculture.

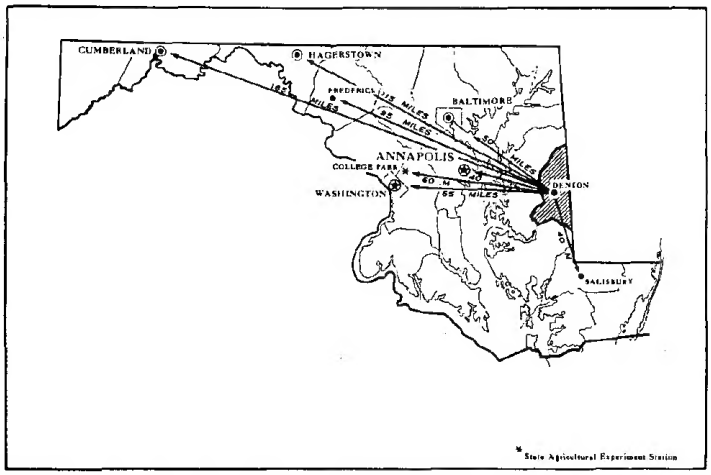

Figure 1.—Location of Caroline County in Maryland.

General Nature of the County

This section gives information about the physiography, relief, and drainage of Caroline County. It also describes the climate and vegetation and discusses the transportation, markets, industries, and agriculture in the county.

Physiography, Relief, and Drainage

Caroline County is in the Atlantic Coastal Plain. Most of the county is between 40 and 60 feet above sea level. The highest point, 75 feet, is about 1 mile southwest of Templeville. The lowest, 5 feet, is at Choptank. Denton is 42 feet above sea level. Changes in elevation are generally gradual, but in some places there are ridges and ravines.

Drainage is entirely into the Chesapeake Bay. Most of the county is drained by the Choptank River and its tributaries, but a small area in the southeastern part is drained by Marshyhope Creek, one of the chief tributaries of the Nanticoke River. Tuckahoe Creek and Hunting Creek, the main tributaries of the Choptank River, form part of the western and southern boundaries of the county. Because the main rivers are tidal streams, and because most of the county is nearly level or gently sloping, the overall drainage is somewhat slow.

Climate [1]

Caroline County has a humid, semicontinental climate. Winter is mild, and summer is rather hot. Spring and fall are the most pleasant seasons.

Maryland lies in the region of eastward moving weather systems; consequently, the influence of the Atlantic Ocean is slight. In summer the temperature is sometimes lowered by cool air from the water. In winter the winds from the northeast are raw and uncomfortable, and bring much of the precipitation. The Appalachian Mountains and the waters of the Chesapeake Bay have a moderating effect on the cold air from the northwest.

Table 1 shows, by months, climatic data taken in the Denton-Ridgely area since 1891.

The hottest time of the year is late in July, when the average maximum afternoon temperature is between 88 and 89° F. The coldest time is at the beginning of February, when the average minimum is about 25°. In an average winter the temperature drops to 5° F. or lower at least once. At Henderson, a temperature of −9° was recorded twice in January 1961. In spring, cold air from the northwest alternating with tropical air from the south or southwest causes marked changes in temperature within a few days. For example, Denton reported a temperature of 32° on April 20, 1960, and 94° on April 23.

Probability of freezing temperatures on or after given dates in spring and on or before given dates in fall have not been computed for Caroline County. The dates given in table 2 for Easton, Md., and Bridgeville, Del., are probably representative of the county.

Precipitation is fairly evenly distributed throughout the year. Only July and August have an average of more than 4 inches of rainfall. Rainfall is more variable and less dependable in summer than in winter. As little as one-tenth of an inch and as much as 9 inches have fallen in August. Local thundershowers are common in summer. During these showers, as much as 2 or 3 inches of rain may fall in one area within 2 or 3 hours, but a few miles away only a few drops may fall. In winter, precipitation occurs in the form of general storms that cover large areas.

Droughts are most likely to occur in summer. Generally, the rainfall is adequate for good yields of crops, but unequal distribution of rainfall in summer and occasional periods of drought may make irrigation advisable.

The annual snowfall is 15 to 20 inches, but the amount varies from year to year. In the winter of 1949–50, less than 1 inch of snow fell in the Denton-Ridgely area, but during the winter of 1898–99, about 46 inches fell. The heaviest snowfall recorded occurred in January 1922, when 18 to 24 inches of snow fell in a 36-hour period.

Thunderstorms occur on an average of 30 to 35 days a year. About three-fourths of the storms are reported in June, July, and August. Hailstorms occur about once or twice a year.

Tornadoes occur infrequently, and most cause little damage. The county is affected by hurricanes about once a year, generally in August. Normally, the effect is minor, but high winds, heavy rains, and floods occasionally result in widespread damage.

In summer the prevailing winds are from the south

[1] A. Delbert Peterson, State climatologist, U.S. Weather Bureau, assisted in the preparation of this section.

Table 1.—*Temperature and precipitation in*

[Station now called the Denton station

Month	Temperature								Average number of days with—		
	Average daily maximum	Average daily minimum	Highest	Year of occurrence	Lowest	Year of occurrence	Average monthly maximum	Average monthly minimum	Maximum of 90 degrees or higher	Minimum of 32 degrees or lower	Minimum of 14 degrees or lower
	°F.	°F.	°F.		°F.		°F.	°F.	°F.	°F.	°F.
January	44	27	77	1932	−17	1893	64	7	0	23	4
February	45	26	79	1930	−14	1899	65	8	0	21	4
March	54	34	91	1926	1	1914	76	18	(1)	16	(1)
April	65	42	97	1896	15	1923	84	28	(1)	4	0
May	75	52	98	[3] 1941	29	1947	90	37	1	(1)	0
June	84	61	104	1925	37	1930	95	45	7	0	0
July	87	66	108	1936	45	1952	97	53	11	0	0
August	85	64	105	1930	42	1902	96	51	8	0	0
September	80	58	98	1953	32	1904	92	40	3	(1)	0
October	69	46	97	1941	23	1909	84	29	(1)	3	0
November	57	37	86	1950	9	1930	74	21	0	11	(1)
December	46	28	72	1951	−4	1917	64	11	0	22	2
Annual	66	45	108	1936	−17	1893	99	3	30	100	10

[1] Less than half a day. [2] Trace.

or southwest, and in winter they are generally from the northwest. Wind velocity has not been recorded in the county. The average wind velocity has been estimated to be 8 to 10 miles an hour, but winds of 50 to 60 miles or more an hour accompany severe thunderstorms and hurricanes in summer and fall and general storms in winter.

The relative humidity is lower in winter and spring and higher in summer. In the afternoon in winter and spring, it averages between 50 and 55 percent; in summer, the afternoon humidity averages 60 percent. Normally, the humidity is highest at sunrise; at that time, it is about 90 percent in summer and 70 to 75 percent in winter and spring.

Vegetation

Probably Caroline County was once covered almost entirely by hardwood trees. Because nearly half the county has impeded drainage, many of the trees were of species that are water loving or at least water tolerant. Oak dominated in most areas; the species depended largely on drainage. Other important trees were swamp maple, sweetgum, blackgum, holly, bay, dogwood, beech, and birch. Loblolly pine and Virginia pine were probably included also, but these did not become extensive or occur as pure stands until after many areas had been cleared of hardwoods. Loblolly pine (sometimes called oldfield pine) then became dominant in heavily cut areas and on abandoned cropland where drainage is impeded, and Virginia pine where the soils are sandy and droughty.

Tidal marsh supports coarse grasses and rushes and also some shrubs and small trees that tolerate brackish water.

Additional information about the vegetation in the county is given under the heading "Woodland" and in the section "Formation, Morphology, and Classification of the Soils."

Industries, Transportation, and Markets

The industries of Caroline County are closely connected to agriculture and to the natural resources. There are canneries, fertilizer mixing plants, crate factories, flour mills, and milk cooling and condensing plants. Sand and gravel deposits are used locally for highway construction and maintenance.

In colonial days, transportation was mainly by water, and all settlements were on or near navigable streams. The waterways are not now an important means of transportation, but small tankers and other boats still come up the Choptank River to Denton.

Modern highways now cross the county, and there are many hard-surfaced secondary roads. Since the opening of the Chesapeake Bay Bridge, Caroline County has been easily accessible by highway from Annapolis and from other points west of the Chesapeake Bay.

The Baltimore and Eastern Railroad has a line through Denton, Preston, and Hillsboro. The Oxford branch of the Pennsylvania Railroad has a line through Ridgely, Greensboro, Goldsboro, Henderson, and Marydel, and the Cambridge branch has a line through Federalsburg.

Caroline County has access to agricultural markets by highway, by rail, and by water. Major markets are Wilmington, Del., Baltimore, Md., and Philadelphia, Pa., but Washington, D.C., and other cities west of the Chesapeake Bay are now accessible.

the Denton-Ridgely area, Caroline County, Md.

was originally the Ridgely station]

Precipitation								Snowfall					
Average monthly total	Wettest year	Year of occurrence	Driest year	Year of occurrence	Maximum during a 24-hour period	Year of occurrence	Average number of days with 0.01 inch or more	Average monthly total	Maximum during a month	Year of occurrence	Maximum during a 24-hour period	Year of occurrence	Average number of days with 0.1 inch or more
Inches	*Inches*		*Inches*		*Inches*			*Inches*	*Inches*		*Inches*		
3.35	8.47	1937	0.86	1955	2.80	1936	10	4	21	[3] 1918	18	1922	2
3.0	6.63	1899	.22	1901	2.24	1896	9	5	30	1899	12	1899	2
3.58	8.35	1912	.73	1894	3.63	1958	10	3	17	1914	12	1931	1
3.31	6.41	1918	.83	1942	2.80	1918	10	[2]	10	1915	10	1915	[1]
3.69	8.74	1948	.25	1911	2.75	1919	10						
3.75	7.81	1902	.19	1949	4.16	1902	9						
4.57	12.02	1945	.66	1957	3.95	1925	10						
4.61	13.83	1911	.11	1943	9.02	1919	9						
3.61	15.65	1935	[2]	1941	8.29	1960	8						
2.99	8.13	1917	.43	1924	2.93	1910	8	[2]	3	[3] 1940	3	[3] 1940	[1]
2.86	8.28	1907	.57	1917	2.92	1956	8	1	7	1953	7	1953	[1]
3.09	6.0	[3] 1957	.83	1896	2.85	1941	10	3	17	1904	11	1908	[2]
42.41	57.59	1935	20.32	1930	9.02	1919	111	16	46	1899	18	1922	7

[3] Also in earlier years.

TABLE 2.—*Probabilities of last freezing temperatures in spring and first in fall*

[Data from Easton, Talbot County, Md., and Bridgeville, Del.]

Probability	Dates for given probability at temperature levels shown					
	32° or lower at—		24° or lower at—		16° or lower at—	
	Easton, Md.	Bridgeville, Del.	Easton, Md.	Bridgeville, Del.	Easton, Md.	Bridgeville, Del.
Spring:						
9 years in 10, later than	March 25	April 5	February 21	March 8	January 26	February 5.
3 years in 4, later than	April 3	April 13	March 2	March 15	February 4	February 14.
2 years in 3, later than	April 6	April 16	March 6	March 17	February 8	February 17.
1 year in 2, later than	April 13	April 22	March 13	March 22	February 15	February 24.
1 year in 3, later than	April 20	April 28	March 20	March 27	February 22	March 3.
1 year in 4, later than	April 23	May 1	March 24	March 29	February 26	March 6.
1 year in 10, later than	May 2	May 9	April 2	April 5	March 7	March 15.
Fall:						
1 year in 10, earlier than	October 14	October 7	November 11	October 29	November 27	November 23.
1 year in 4, earlier than	October 21	October 14	November 19	November 6	December 3	November 30.
1 year in 3, earlier than	October 23	October 16	November 22	November 9	December 6	December 3.
1 year in 2, earlier than	October 28	October 21	November 28	November 15	December 10	December 8.
2 years in 3, earlier than	November 2	October 26	December 4	November 21	December 14	December 13.
3 years in 4, earlier than	November 4	October 28	December 7	November 24	December 17	December 16.
9 years in 10, earlier than	November 11	November 4	December 15	December 2	December 23	December 23.

Agriculture

Agriculture is diversified in Caroline County. Responsive soils, a temperate climate, adequate and well-distributed rainfall, and a fairly long growing season make conditions favorable for agriculture. The soils are well suited to general farming and to truck farming. Many, however, need artificial drainage.

In 1959 there were 1,177 farms in the county. They occupied a total of 156,771 acres. The average size was 133.2 acres.

Some facts about the crops grown in the county, pastures, livestock and livestock products, and poultry and poultry products are discussed in the following pages. The statistics used are from the United States Census of Agriculture for 1959.

Crops and pasture

Crops were harvested from 87,262 acres in 1959. Corn occupied the largest acreage of any crop, and soybeans the next largest. Other crops, in order of their importance, were wheat, various hay crops, particularly lespedeza, and vegetables.

Only the most important vegetables are included in the following list. Vegetables grown for sale, other than those listed, are snap beans, cucumbers, and melons.

	Acres in 1959
Corn, all purposes	28,435
Soybeans, all purposes	28,275
Small grains harvested:	
Wheat	10,518
Barley	5,432
Rye	2,607
Oats	1,290
Hay crops, total	9,630
Lespedeza	5,931
Clover, timothy, and mixtures of clover and grasses	2,486
Alfalfa	377
Small grains	242
Other hay	594
Vegetables for sale	9,097
Sweet corn	3,065
Tomatoes	1,563
Green peas	1,182
Lima beans	1,059
Other vegetables	2,228
Pasture, total	12,898
Cropland used for pasture	10,780
Woodland used for pasture	440
Other pasture (includes improved pasture)	1,898

Poultry and livestock

Raising poultry is an important enterprise in Caroline County. Poultry and poultry products accounted for 51.4 percent of the value of all farm products sold in this county in 1959. The value of livestock and livestock products was only 4.9 percent of the value of all farm products sold.

The following list gives the number of livestock in the county in 1959, and the amount of dairy and poultry products sold in that year.

	Number
Cattle, all ages	10,725
Milk cows	5,494
Whole milk sold (pounds)	26,448,385
Hogs and pigs	8,075
Horses and mules	447
Sheep and lambs	203
Chickens sold	10,169,592
Broilers sold	10,113,461
Chicken eggs sold (dozens)	699,164

How Soils Are Mapped and Named

In making a soil survey, soil scientists study and map the soils in detail. To examine the subsoil and deeper layers, they bore holes with an auger or dig with a spade. They also study soils in banks, roadcuts, and in pits and other excavations.

Each boring or hole reveals a soil profile. Each pro-

file consists of one or more distinct layers, called horizons, over a substratum of clay, gravel, sand, or other material. Soil scientists designate different kinds of horizons by capital letters. The A horizon is the upper layer, just beneath the leaf litter or vegetation. It consists of the surface layer and, in places, a subsurface layer. The B horizon is a subsoil that developed as the result of soil formation processes. The C horizon is the parent material from which the soil formed. The D horizon is beneath the C horizon, or beneath the A or B horizon if some of the layers are missing. The D horizon may not be the same kind of material as that from which the soil formed.

Each major horizon, A, B, C, or D, may consist of one or more layers, or subhorizons, each different from the others. Thus, one soil may have A1, A2, B1, B2, and C horizons; another soil may have A1, B2, B3, C, and D horizons; and still another, A11, A12, C1, C2, and D horizons. The properties and thickness of the various horizons and their arrangement help in characterizing and classifying soils.

Texture, color, and other properties generally vary among horizons. In Caroline County, the surface layer in most soils is darker colored than the lower layers; the subsoil layers are brighter or more intense in color; and mottling may be present in the lower horizons. The characteristics described in the following paragraphs are among the more important ones considered by soil scientists.

Texture refers to the content of sand, silt, and clay in the soil. Texture is judged by feel and, to some extent, by the appearance of the soil. It is later checked by mechanical analysis in the laboratory. The finest particles are clay. Individual particles of clay are so fine that they can scarcely be seen through a microscope. Soils that consist principally of clay are generally plastic and sticky when wet and rather hard when dry. They retain moisture and plant nutrients well. Water moves slowly through clay soils.

Medium-sized particles, large enough to be seen with a microscope, are called silt. Silty soils are smooth and velvety; some are silky to the touch. They are generally not so hard when dry nor so sticky and plastic when wet as clay soils.

Individual particles of sand can be seen with the naked eye. Water moves rapidly through sandy soils, and these soils retain relatively little water for plants. Some soils in Caroline County also contain some fine gravel, but this does not directly affect texture.

Most soils contain variable amounts of clay, silt, and sand. Few soils anywhere are pure silt or pure sand, and none are known that are pure clay. Within any one soil, the different horizons may have different proportions of sand, silt, and clay. One soil in Caroline County contains very little sand, silt, or clay. It is composed of well-decomposed organic matter and is known as Muck.

Structure is the arrangement of individual soil particles in clumps or aggregates. Some soils are loose and crumbly when dry. Others can be broken down into small clods that resemble blocks, and still others into small, flattened aggregates that resemble plates. The structure of a soil horizon helps determine whether air, water, and plant roots will penetrate easily or with difficulty. The structure varies among soils, and in some soils it differs among horizons.

Color is another indication of soil properties. Dark-colored soils are generally higher in organic matter, and, other things being equal, are more productive and more easily tilled than light-colored soils. Color also indicates the degree of natural drainage. In Caroline County most of the well-drained soils are reddish brown, yellowish brown, brownish yellow, yellowish red, or reddish yellow. Poorly drained soils have a subsoil that is dominantly gray and generally mottled with yellow, red, or brown.

The wetness of an area, the color of the soil, and the position of the soil in the landscape are factors that indicate the degree of drainage. In Caroline County drainage varies widely, and this variation is a major cause of the differences in the suitability of the soils for crops. The terms used to denote the successive grades, or degrees, of soil drainage are *excessively drained*, *somewhat excessively drained*, *well drained*, *moderately well drained*, *somewhat poorly drained*, *poorly drained*, and *very poorly drained*.

Acidity and other chemical properties help to indicate the way in which soils were formed, the management they may need, and how productive they may be.

Topography, or lay of the land, is frequently associated with fairly definite combinations of soil characteristics. Certain soils occur only on flood plains, others occur only in depressions, and still others occur only on rolling uplands.

Different combinations of soil characteristics, such as those we have discussed, are the bases for separating one soil from another. In determining the kinds of soils mapped in a county, the combinations of soil properties emphasized are those that are important in agriculture and in other uses of the soils. The kinds of soils are then grouped into soil series, types, and phases.

A soil series is a group of soils that, except for the texture of the surface layer, have the same profile characteristics and the same general range in color, structure, consistence, and sequence of horizons. All soils of the same series formed in the same kind of parent material. Soils of a given series may vary in slope and in other external characteristics but are reasonably uniform in internal characteristics. Each soil series is given a name, generally one taken from the locality where the series was first recognized and described. Elkton and Fallsington are names of important soil series in Caroline County.

A soil type is a subdivision of a soil series. The texture of the surface layer is the basis for distinguishing a soil type within a series. A series may consist of one type or of many types. Thus, Elkton loam and Elkton silt loam are soil types within the Elkton series.

Variations within the soil type—chiefly in such external characteristics as slope, stoniness, or accelerated erosion—are recognized by designating soil phases or mapping units. In Caroline County, Woodstown sandy loam, 0 to 2 percent slopes, and Woodstown sandy loam, 2 to 5 percent slopes, moderately eroded, are two phases of the soil type, Woodstown sandy loam. If erosion has been slight or negligible, it is not included in the name of the soil phases. If it has been moderate, severe, or very severe, it is mentioned in the phase name. If a soil is nearly level, slope is not given as part of its name.

Some areas shown on a soil map are not true soils and are called land types. Examples are Swamp, Tidal marsh, Mixed alluvial land, and Made land. Mixed alluvial land consists of two or more kinds of soil material on flood plains.

The process of assigning uniform names to the same kind of soil in various areas is called soil correlation. This is part of the nationwide system of mapping and classifying soils. Its purpose is to show similarities and differences among soils of each surveyed area and the rest of the United States.

Soils do not change abruptly at political or other man-made boundaries. Many of the soils of Caroline County are found also in other eastern States from New Jersey and Pennsylvania southward to Florida and the Gulf Coast. Valuable information about the use and management of these soils may be available in other counties or States. For example, practices used to grow truck crops in New Jersey or Delaware can be used on the same kind of soils in Caroline County. By assigning the same name to the same soil, wherever mapped, such comparisons of management practices and of soils are made easier.

General Soil Map

After study of the soils in a locality and the way they are arranged, it is possible to make a general map that shows several main patterns of soils, called soil associations. Such a map is the colored general soil map in the back of this report. Each association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic although not strictly uniform.

The soils within any one association are likely to differ from each other in some properties: for example, slope, depth, stoniness, or natural drainage. Thus, the general soil map shows, not the kind of soil at any particular place, but patterns in each of which there are several different kinds of soil.

Each soil association is named for the major soil series in it, but, as already noted, soils of other series may also be present. The major soils of one association may also be present in another association but in a different pattern.

The general map showing patterns of soils is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

The four soil associations in Caroline County shown on the general soil map in the back of this report are described in the paragraphs that follow.

1. Sassafras-Galestown-Fallsington association

Moderately coarse textured and coarse textured soils that are mostly well drained to excessively drained

This soil association makes up about 45 percent of the county. It consists of well-drained to excessively drained, nearly level to gently sloping soils that developed in thick beds of sand or of sandy material containing silt and clay. It is between the Choptank River and the watershed divide between the Choptank River and Marshyhope Creek.

Sassafras and Galestown soils are dominant in this association. They are moderately coarse textured and coarse textured. The poorly drained, nearly level Fallsington soils make up most of the rest of the association. Soils in this association are easily tilled and are well suited to truck crops. They need less artificial drainage than the soils in other associations. Crops can be planted early in the spring. Yields are fair to moderately high and can be increased by fertilization and general good management. Supplemental irrigation would be beneficial during dry periods. The farms are mostly of the general type.

2. Sassafras-Fallsington-Woodstown association

Mostly moderately coarse textured soils that are well drained to poorly drained

This association makes up about 21 percent of the county. It consists of well-drained to poorly drained soils that developed in silty or clayey sandy material or in sandy clay. It is west of the Choptank River and south of a line that runs roughly between Greensboro and Bridgetown.

In general, the soils in this association are slightly less coarse textured than those in association 1, and a larger part of association 2 consists of soils that need drainage. Sassafras soils, which are dominant, are well drained. Fallsington soils are poorly drained, and Woodstown soils are moderately well drained.

The soils in this association retain moisture and plant nutrients better than those in association 1; consequently, yields are somewhat higher. Fertilizer requirements are high, but the response is good. Some areas would be benefited by irrigation. Woodstown soils need surface drainage at times. They are slow to warm up in spring and are unsuited to early planting. Fallsington soils need a complete drainage system. The farms in this association are of the general type.

3. Fallsington-Woodstown-Sassafras association

Mostly poorly drained soils

This association makes up about 17 percent of the county. It consists mostly of moderately coarse textured, poorly drained soils. It occupies all of the southeastern part of the county that is not in association 1 and extends to the Delaware State line.

The chief soils are the same as in association 2, but poorly drained Fallsington soils are dominant instead of well-drained Sassafras soils. Consequently, a larger proportion of the acreage needs a complete drainage system to make it suitable for crops. Forests and undeveloped areas are more common than in other parts of the county, except possibly the extreme northern part.

4. Pocomoke-Fallsington association

Poorly drained and very poorly drained soils

This association makes up about 17 percent of the county. It occupies the extreme northern part of the county.

Very poorly drained Pocomoke soils dominate this association, but there are large areas of poorly drained Fallsington soils. Included are areas of well-drained Sassafras

soils, which occupy the higher interfluvial ridges, and small areas of other soils.

Most of the soils in this association require drainage. Drained areas are suitable for general farming. Many of the poorly drained areas have never been cleared or have reverted to trees and forest cover.

Descriptions of the Soils

In this section the soils of Caroline County are described in detail. Descriptions of the soil series, arranged in alphabetic order, give the characteristics that are common to all the soils in each series. Descriptions of the mapping units give the characteristics that differentiate types and phases within each series.

An important part of each series description is the soil profile. This is a record of what the soil scientist observed when he studied the soils of the particular series in the field. All the soils of one series have essentially the same profile. Differences in surface texture, in slope, and in degree of erosion are usually evident from the names of the mapping units.

In describing the soils, some technical terms have been used because there seems to be no other practical way to describe soils accurately and briefly. Such terms used in this report are defined in the Glossary.

The location and distribution of the individual soils are shown on the detailed map at the back of this report. The approximate acreage and proportionate extent of the soils are given in table 3.

TABLE 3.—*Approximate acreage and proportionate extent of the soils mapped*

Soil	Acres	Percent	Soil	Acres	Percent
Bayboro silt loam	786	0.4	Sassafras loam, heavy substratum, 0 to 2 percent slopes	327	0.2
Bibb silt loam	240	.1	Sassafras loamy sand, 0 to 2 percent slopes	8,665	4.2
Elkton loam	848	.4	Sassafras loamy sand, 2 to 5 percent slopes	8,211	4.0
Elkton silt loam	831	.4	Sassafras loamy sand, 2 to 5 percent slopes, moderately eroded	2,348	1.1
Fallsington loam	9,457	4.6	Sassafras loamy sand, 5 to 10 percent slopes	523	.3
Fallsington sandy loam	31,539	15.4	Sassafras loamy sand, 5 to 10 percent slopes, moderately eroded	285	.1
Galestown loamy sand, 0 to 2 percent slopes	8,934	4.4	Sassafras loamy sand, 5 to 10 percent slopes, severely eroded	189	.1
Galestown loamy sand, 2 to 5 percent slopes	2,479	1.2	Sassafras loamy sand, 10 to 15 percent slopes	273	.1
Galestown loamy sand, 5 to 10 percent slopes	215	.1	Sassafras loamy sand, 15 to 30 percent slopes	368	.2
Galestown loamy sand, 10 to 15 percent slopes	236	.1	Sassafras sandy loam, 0 to 2 percent slopes	29,095	14.2
Galestown loamy sand, 15 to 30 percent slopes	449	.2	Sassafras sandy loam, 2 to 5 percent slopes	4,366	2.1
Galestown loamy sand, 30 to 60 percent slopes	229	.1	Sassafras sandy loam, 2 to 5 percent slopes, moderately eroded	28,386	13.9
Galestown sand, 0 to 2 percent slopes	1,833	.9	Sassafras sandy loam, 2 to 5 percent slopes, severely eroded	62	(1)
Galestown sand, 2 to 5 percent slopes	1,735	.8	Sassafras sandy loam, 5 to 10 percent slopes	258	.1
Galestown sand, 5 to 10 percent slopes	154	.1	Sassafras sandy loam, 5 to 10 percent slopes, moderately eroded	472	.2
Galestown sand, 10 to 15 percent slopes	105	.1	Sassafras sandy loam, 5 to 10 percent slopes, severely eroded	400	.2
Galestown sand, 15 to 30 percent slopes	280	.1	Sassafras sandy loam, 10 to 15 percent slopes	187	.1
Johnston loam	3,396	1.7	Sassafras sandy loam, 10 to 15 percent slopes, moderately eroded	102	.1
Klej loamy sand, 0 to 2 percent slopes	1,236	.6	Sassafras sandy loam, 15 to 30 percent slopes	901	.4
Klej loamy sand, 2 to 5 percent slopes	317	.2	Sassafras sandy loam, 30 to 60 percent slopes	162	.1
Lakeland loamy sand, clayey substratum, 0 to 2 percent slopes	184	.1	Sassafras sandy loam, heavy substratum, 0 to 2 percent slopes	858	.4
Lakeland loamy sand, clayey substratum, 2 to 5 percent slopes	1,064	.5	Sassafras sandy loam, heavy substratum, 2 to 5 percent slopes	212	.1
Lakeland loamy sand, clayey substratum, 5 to 10 percent slopes	243	.1	Swamp	1,906	.9
Lakeland sand, clayey substratum, 2 to 10 percent slopes	79	(1)	Tidal marsh	2,775	1.4
Made land	31	(1)	Woodstown loam, 0 to 2 percent slopes	3,144	1.5
Matapeake silt loam, 0 to 2 percent slopes	110	.1	Woodstown loam, 2 to 5 percent slopes, moderately eroded	220	.1
Matapeake silt loam, 2 to 5 percent slopes, moderately eroded	246	.1	Woodstown sandy loam, 0 to 2 percent slopes	17,025	8.3
Matapeake silt loam, 15 to 30 percent slopes	62	(1)	Woodstown sandy loam, 2 to 5 percent slopes	496	.2
Mattapex silt loam, 0 to 2 percent slopes	378	.2	Woodstown sandy loam, 2 to 5 percent slopes, moderately eroded	1,731	.8
Mattapex silt loam, 2 to 5 percent slopes, moderately eroded	78	(1)	Woodstown sandy loam, 5 to 10 percent slopes	71	(1)
Mattapex silt loam, 15 to 30 percent slopes	59	(1)	Borrow and gravel pits	99	.1
Mixed alluvial land	2,595	1.3	Total	204,800	100.0
Muck	168	.1			
Othello silt loam	435	.2			
Plummer loamy sand	492	.2			
Pocomoke loam	10,566	5.2			
Pocomoke sandy loam	2,828	1.4			
Portsmouth silt loam	96	.1			
Sassafras loam, 0 to 2 percent slopes	4,738	2.3			
Sassafras loam, 2 to 5 percent slopes, moderately eroded	932	.5			

[1] Less than 0.1 percent.

TABLE 4.—*Relationships of the soils according to topographic position, parent material, and drainage*

Position and parent material	Excessively drained	Somewhat excessively drained	Well drained	Moderately well drained	Poorly drained	Very poorly drained
Uplands and terraces—						
Sand and loamy sand	Galestown, Lakeland.[1]	Galestown, Lakeland.[1]		Klej [3]	Plummer	
Sand, silt, and clay		Sassafras [2]	Sassafras [2]	Woodstown	Fallsington	Pocomoke.
Silt deposited over sand			Matapeake	Mattapex	Othello	Portsmouth.
Clay and silty clay					Elkton	Bayboro.
Swamps and marshes—						
Organic material						Muck.[4]
Flood plains—						
Sand, silt, and clay					Bibb	Johnston.

[1] Galestown and Lakeland soils occur in both the somewhat excessively drained and the excessively drained range. They differ from each other chiefly in the color of their subsurface horizons.

[2] Sassafras loamy sand is in the somewhat excessively drained range. Sassafras sandy loam and Sassafras loam are in the well-drained range.

[3] Klej soils are moderately well drained to somewhat poorly drained.

[4] Muck is mapped in Caroline County but has not been given a soil series name.

The soils in this county can be considered in three broad groups according to their position on the landscape: Soils of the uplands and terraces (about 95 percent of the county area), soils of the river flood plains (about 3 percent of the county area), and soils of the swamps and marshes (about 2 percent of the county area). Within these topographic groups, the soils vary according to their drainage.

Table 4 shows these relationships of the soils of Caroline County.

Bayboro Series

The Bayboro series consists of very dark gray to black, very poorly drained soils on flats and in depressions. These soils developed in acid clay.

Bayboro soils resemble Pocomoke and Portsmouth soils in color and drainage. Pocomoke soils developed from somewhat sandy material and Portsmouth soils developed from highly silty material. Bayboro soils developed in the same kind of material as Elkton soils but are more poorly drained and have a darker colored surface layer.

Bayboro soils are not extensive in Caroline County. They occur as scattered areas. Most of the acreage is in pasture or wetland forest. Because they are difficult to drain, these soils are not commonly used for crops.

Profile of Bayboro silt loam in an idle area just south of Cherry Lane, about 3 miles southeast of Bridgetown:

A1p—0 to 7 inches, black (10YR 2/1) silt loam; highly organic; very weak, fine to medium, crumb structure; friable when moist, slightly plastic and slightly sticky when wet; roots plentiful; very strongly acid; abrupt, smooth boundary; horizon is 6 to 8 inches thick.

A12—7 to 16 inches, black (N 2/0) heavy silt loam or silty clay loam; highly organic; very weak, coarse, blocky structure and very weak, medium, crumb structure; firm when moist, plastic and sticky when wet; very few roots; very few pores; extremely acid; clear to abrupt, smooth boundary; horizon is 6 to 10 inches thick.

B2g—16 to 36 inches, olive-gray (5Y 5/2) clay; very weak, coarse, blocky structure; very firm when moist, very plastic and very sticky when wet; no roots; few visible pores; very strongly acid; gradual, smooth boundary; horizon is 16 to 24 inches thick.

Cg—36 to 44 inches, gray (5Y 5/1) fine sandy clay; few, fine, distinct mottles of yellowish brown (10YR 5/4); massive; firm when moist, very plastic and very sticky when wet; no roots; no visible pores; very strongly acid; abrupt, smooth boundary; horizon is 7 to 10 inches thick.

Dg—44 to 50 inches +, gray to light-gray (5Y 6/1) loamy sand; common, medium, distinct mottles of dark yellowish brown (10YR 4/4); no structure; very friable when moist, nonplastic and nonsticky when wet; no roots; very strongly acid.

In cuplike depressions, where fine material washed from the adjacent uplands has accumulated, the A horizon is thicker than that in the profile described. In some places the depth to the D horizon is more than 50 inches. In these areas the B and C horizons are thicker.

Bayboro silt loam (Bo).—This is the only Bayboro soil in Caroline County. It is nearly level and occurs as small to fairly large areas in slight depressions. Its profile is the one described as representative of the series. Included are small areas of a soil that is almost as fine as silty clay loam.

Because this soil is difficult to drain, much of the acreage is still forested. If adequately drained, however, this soil is suitable for many of the crops commonly grown and also can be used for wetland pasture. (Capability unit IIIw-9; drainage group 9-6B; sewage disposal group 7; woodland suitability group 6)

Bibb Series

The Bibb series consists of poorly drained soils on flood plains. These soils are composed of recent alluvial deposits washed from silty soils on the uplands.

Bibb soils are better drained and lighter colored than Johnston soils. They resemble Fallsington, Othello, and Elkton soils, but they are more silty and show less evidence of profile development.

Bibb soils occupy a very small acreage in the county. They are subject to flooding. If properly drained they can be used for crops or pasture. In undrained areas the water table is at or near the surface during wet periods, and it is seldom more than 3 feet below the surface.

Profile of Bibb silt loam in a pasture on the flood plain of Gravelly Branch, just south of Sewell Mills:

Ap—0 to 9 inches, olive-brown (2.5Y 4/4) silt loam; weak, fine, crumb to granular structure; friable when moist, slightly sticky but nonplastic when wet; roots plentiful; very strongly acid; abrupt, smooth boundary; horizon is 9 to 10 inches thick.

C1g—9 to 23 inches, olive-gray (5Y 4/2) heavy silt loam; common, fine, prominent mottles of dark reddish brown (5YR 3/4); massive to very weak, very coarse, blocky structure; firm when moist, sticky and slightly plastic when wet; few roots (almost no roots in lower part); extremely acid; gradual, smooth boundary; horizon is 12 to 16 inches thick.

C2g—23 to 41 inches, dark-gray (5Y 4/1) very fine sandy loam or light silt loam; common, medium, distinct mottles of dark yellowish brown (10YR 4/4); massive; friable to firm when moist, slightly sticky and slightly plastic when wet; practically no roots; extremely acid; abrupt, smooth boundary; horizon is 13 to 20 inches thick.

Dg—41 to 50 inches +, gray to light-gray (5Y 6/1) fine gravelly sandy loam; common, very coarse, distinct mottles or splotches of dark yellowish brown (10YR 4/4); massive; friable when moist, slightly sticky but nonplastic when wet; no roots; extremely acid.

In unplowed areas the A1 horizon is dark gray to dark olive gray in color and is commonly only 2 to 5 inches thick.

Bibb silt loam (Bm).—This is the only Bibb soil in the county. The profile is the one described as representative of the series. If drained and protected from floods, this soil is suited to pasture and to most general farm crops, including corn and soybeans. Some areas are in hardwoods, and a few are in loblolly pine or pond pine. (Capability unit IIIw–7; drainage group 11A; sewage disposal group 8; woodland suitability group 4)

Elkton Series

The Elkton series consists of poorly drained soils that have a moderately fine textured to fine textured, very slowly permeable subsoil. These soils developed in beds of clay, silty clay, and silty clay loam, which in some places overlie a sandy substratum.

Elkton soils are similar to Fallsington and Othello soils but are less sandy than Fallsington soils and less silty than Othello soils. Because the subsoil is finer textured, they are more difficult to drain, and to manage after they have been drained, than either Fallsington or Othello soils. Elkton soils developed in the same kind of material as the very poorly drained and darker colored Bayboro soils.

Elkton soils are inextensive in Caroline County. Most of the acreage is wooded. A small part is used for crops or for pasture.

Profile of Elkton loam in a loblolly pine forest on Frazier Neck Road, about 2½ miles south of Tanyard:

A1—0 to 1 inch, very dark grayish-brown (2.5Y 3/2) loam; weak, medium, crumb structure; friable when moist, nonplastic but slightly sticky when wet; roots plentiful; very strongly acid; clear, smooth boundary; horizon is ½ to 1 inch thick.

A2—1 to 10 inches, gray (5Y 5/1) heavy loam; weak, fine, crumb structure; friable when moist, slightly plastic and slightly sticky when wet; roots plentiful; extremely acid; clear, wavy boundary; horizon is 8 to 10 inches thick.

B21g—10 to 19 inches, gray (5Y 5/1) heavy silty clay loam; common, coarse, prominent mottles of yellowish brown (10YR 5/6); weak, medium, blocky and subangular blocky structure; firm when moist, plastic and sticky when wet; roots fairly common; very strongly acid; gradual, wavy boundary; horizon is 8 to 12 inches thick.

B22g—19 to 38 inches, gray to light-gray (5Y 6/1) silty clay; common, coarse, distinct mottles of strong brown (7.5YR 5/6); weak, medium to coarse, blocky structure; very firm when moist, plastic and very sticky when wet; a few roots; some thin, gray (N 5/0) coatings on blocks and in old root channels; very strongly acid; clear, smooth boundary; horizon is 16 to 20 inches thick.

Cg—38 to 44 inches, dark-gray (5Y 4/1) silty clay; few, coarse, distinct mottles of yellowish brown (10YR 5/4); massive to very weak, very coarse, blocky structure; very firm when moist, sticky and very plastic when wet; a very few scattered roots; extremely acid; clear, smooth boundary; horizon is 4 to 6 inches thick.

Dg—44 to 60 inches +, light-gray (5Y 7/1) heavy sandy loam; abundant, medium, prominent mottles of yellowish brown (10YR 5/6); massive; friable when moist, slightly plastic and very slightly sticky when wet; no roots; extremely acid.

The surface layer is loam or silt loam. In cultivated areas the plow layer is generally dark grayish brown (2.5Y 4/2) to dark gray (5Y 4/1). In some places the combined thickness of the surface layer and subsoil is more than 40 inches. In some areas the Cg horizon is much thicker than that in the profile described. In some areas the Cg horizon is absent and the subsoil rests directly on the Dg horizon. The texture of the Dg horizon is clay loam, sandy loam, loamy sand, or sand. At or near sea level, the substratum is less acid than in the profile described.

Elkton loam (Ek).—Most of this soil is level, or nearly so. A few acres have a slope of slightly more than 2 percent. The profile is the one described as representative of the series. If drained, this soil is suited to corn and soybeans, but it is difficult to drain because of the very slow permeability of its subsoil. Some of it is now used for grazing, but most of it is wooded. Water-tolerant hardwoods predominate, but loblolly pine trees are scattered among the hardwoods, and in places there are nearly pure stands of loblolly pine. (Capability unit IIIw–9; drainage group 8–2B; sewage disposal group 7; woodland suitability group 6)

Elkton silt loam (Em).—Except for the finer texture of its A horizon, this nearly level soil is like Elkton loam. If drained, it is suited to corn and soybeans. It is difficult to drain because of the very slow permeability of its subsoil. (Capability unit IIIw–9; drainage group 8–2B; sewage disposal group 7; woodland suitability group 6)

Fallsington Series

The Fallsington series consists of poorly drained soils that have a gray, medium textured to moderately coarse textured surface layer. The subsoil is mottled heavy sandy loam to sandy clay loam, and the substratum is loamy sand. These soils occur on uplands. They formed in beds of unconsolidated material that is predominantly sandy but contains significant amounts of silt and clay.

Fallsington soils formed in the same kind of parent material as Sassafras, Woodstown, and Pocomoke soils. They are more poorly drained than Sassafras and Woods-

town soils but are better drained than Pocomoke soils. Fallsington soils are similar to Othello and Elkton soils but are less silty and clayey and are less difficult to drain.

Soils of the Fallsington series are extensive in this county and are important in agriculture. If adequately drained, they can be used for most of the crops commonly grown in the area.

Profile of Fallsington loam in a hardwood forest about 3½ miles east of Hobbs, half a mile west of the Delaware State line:

A1—0 to 2 inches, very dark brown (10YR 2/2) loam; weak, medium, crumb structure; friable when moist, nonplastic but slightly sticky when wet; roots abundant; extremely acid; clear, smooth boundary; horizon is 1 to 3 inches thick.

A2—2 to 6 inches, dark grayish-brown (2.5Y 4/2) loam; very weak, coarse, crumb structure; friable when moist, slightly plastic and slightly sticky when wet; roots plentiful; extremely acid; clear, smooth boundary; horizon is 3 to 5 inches thick.

B21g—6 to 14 inches, gray to light-gray (5Y 6/1) light sandy clay loam; few, medium, distinct mottles or brownish yellow (10YR 6/6); very weak, medium, subangular blocky structure; friable when moist, slightly plastic and slightly sticky when wet; roots fairly common; extremely acid; gradual, smooth boundary; horizon is 6 to 9 inches thick.

B22g—14 to 24 inches, gray to light-gray (5Y 6/1) sandy clay loam; common, coarse, distinct mottles of yellowish brown (10YR 5/6); weak, coarse, blocky structure; firm when moist, plastic and sticky when wet; very few roots; extremely acid; gradual, smooth boundary; horizon is 10 to 12 inches thick.

B3g—24 to 35 inches, light-gray (5Y 7/2) sandy loam; common, medium, distinct mottles of yellowish brown (10YR 5/4); very weak, coarse, blocky structure; friable when moist, slightly plastic and slightly sticky when wet; no roots; extremely acid; abrupt, smooth boundary; horizon is 10 to 15 inches thick.

Dg—35 to 50 inches +, light-gray (5Y 7/2) loamy sand; structureless; loose; no roots; extremely acid.

The texture of the surface layer is loam or sandy loam. In some areas the A horizon is as much as 10 to 12 inches thick. In some areas the B3g horizon is absent and the B22g horizon rests directly on the Dg horizon. In these areas the depth to the Dg horizon is 20 to 28 inches; it is most commonly about 24 inches. In cultivated areas the plow layer is dark grayish brown (2.5Y 4/2 or 10YR 4/2) and is commonly as much as 10 inches deep.

Fallsington loam (Fa).—Most of this soil is level or nearly so. A few acres have a slope of more than 2 percent. The profile is the one described as representative of the series. This is an important agricultural soil. The water table is high, but the subsoil is permeable, and, if adequately drained, this soil is suited to most of the crops commonly grown in the area. (Capability unit IIIw–7; drainage group 7–A; sewage disposal group 7; woodland suitability group 3)

Fallsington sandy loam (Fs).—The surface layer of this nearly level soil is more friable than that of Fallsington loam, and it is easier to work over a wider range of moisture content. A few small areas have a slope of more than 2 percent. This is the most extensive soil in the county, and it is important to agriculture. The subsoil is permeable, and, if adequately drained, this soil can be used for most crops commonly grown in the county. (Capability unit IIIw–6; drainage group 7–B; sewage disposal group 7; woodland suitability group 3)

Galestown Series

The Galestown series consists of deep, sandy, level to somewhat rolling or hilly, excessively drained and somewhat excessively drained soils that have a brown, sandy subsoil and, commonly, a finer textured, moisture-retaining substratum. These soils occur on uplands, or on old terraces along major streams, generally on the southern or eastern side of the stream. They formed in deep beds of sand deposited over older beds of finer textured material. Some areas are dunelike.

Galestown soils are associated with Lakeland soils and with the coarser textured Sassafras soils. They are browner and less yellow than Lakeland soils. They have a coarser textured subsoil than Sassafras soils and ordinarily are coarser textured throughout. Galestown soils formed in the same kind of parent material as Klej soils, which are moderately well drained, and Plummer soils, which are poorly drained.

Soils of the Galestown series are extensive in Caroline County. Except for the areas that are too sandy or too strongly sloping to be suitable for crops, these soils are important in agriculture; they are particularly good for truck crops.

Profile of Galestown loamy sand, 2 to 5 percent slopes, in a cultivated area northeast of Tanyard, about three-eighths of a mile south of Providence Landing Road:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) loamy sand; structureless; loose; roots plentiful; strongly acid; clear, smooth boundary; horizon is 8 to 10 inches thick.

A2—10 to 18 inches, brown (10YR 5/3) loamy sand; structureless; loose; roots common; very strongly acid; clear, wavy boundary; horizon is 8 to 10 inches thick.

B—18 to 34 inches, strong-brown (7.5YR 5/6) loamy sand; very weak, fine, blocky to single-grain structure; very friable when moist, nonplastic and nonsticky when wet; roots common in upper portion; perhaps contains slightly more fine material (silt or clay) than A horizons; very strongly acid; clear, irregular boundary; horizon is 15 to 30 inches thick.

C1—34 to 40 inches, yellowish-brown (10YR 5/4) light loamy sand; structureless; loose to very friable when moist; very few roots; contains some inclusions (ovoid or spherical) of material apparently identical with that of the B horizon; these inclusions range from less than ½ inch to about 1½ inches in diameter; extremely acid; gradual, irregular boundary; horizon is 4 to 8 inches thick.

C2—40 to 54 inches +, pale-brown (10YR 6/3) sand; structureless; loose; no roots; extremely acid.

In places the texture is sand or loamy sand throughout the profile. The sand grains are coated with fine material; consequently, the soils are classed as "dirty" sand, in contrast to the "clean" sand of other series. In unplowed areas the A1 horizon is dark gray and is only 2 to 4 inches thick. In some areas the B horizon is reddish brown or yellowish red. It is redder than the A or C horizons. Below the C2 horizon, at a depth of 60 to 72 inches, there is commonly a D horizon of sandy loam or sandy clay loam. This horizon retains considerable moisture in dry seasons, and the permanent water table is somewhere within it.

Galestown loamy sand, 0 to 2 percent slopes (GaA).—This soil occurs as broad, flat areas adjacent to major streams but well above the stream level. It is droughty, and fertility is low. It is one of the more extensive soils in the county. Cleared areas are used for crops, mainly

soybeans and truck crops. Crops would benefit greatly from supplemental irrigation during the driest part of the growing season. Many areas are covered with scrub hardwoods mixed in some places with Virginia pine, loblolly pine, and shortleaf pine. (Capability unit IIIs 1; sewage disposal group 1; irrigation group 1; woodland suitability group 2)

Galestown loamy sand, 2 to 5 percent slopes (GaB).—In some places this soil has slopes that are fairly long and smooth. In other places the slopes are broken and are complex or hummocky. The profile is the one described as representative of the series.

This soil is droughty and low in fertility. It is an extensive soil in the county. Cleared areas are used for crops, mainly soybeans and truck crops. Crops would benefit greatly from supplemental irrigation during the driest part of the growing season. (Capability unit IIIs–1; sewage disposal group 1; irrigation group 1; woodland suitability group 2)

Galestown loamy sand, 5 to 10 percent slopes (GaC).—Because it has stronger and somewhat irregular slopes, this soil requires different and more intensive management than the other Galestown soils. It has low fertility and is droughty, but it can be used for cultivated crops if erosion is controlled. (Capability unit IVs–1; sewage disposal group 2; irrigation group 1; woodland suitability group 2)

Galestown loamy sand, 10 to 15 percent slopes (GaD).—This soil is not suitable for cultivation, because it has steep and irregular slopes, low available moisture capacity, and low fertility. Very careful management is needed if it is used as pasture. It can be used for orchards and woodland. (Capability unit VIs–1; sewage disposal group 2; woodland suitability group 2)

Galestown loamy sand, 15 to 30 percent slopes (GaE).—This soil is so steep and so droughty that it is not suitable for cultivation and has only limited use for grazing. It can be used for woodland or for wildlife areas. (Capability unit VIIs–1; sewage disposal group 3; woodland suitability group 2)

Galestown loamy sand, 30 to 60 percent slopes (GaF).—This soil occurs on the sides of narrow ravines or on other sharp breaks. It has some of the steepest and most irregular slopes in the county. The slopes are generally short. This soil is not suitable for crops or pasture, but it can be used for woodland. (Capability unit VIIs–1; sewage disposal group 3; woodland suitability group 2)

Galestown sand, 0 to 2 percent slopes (GsA).—This soil is like Galestown loamy sand, 0 to 2 percent slopes, except that it is more sandy throughout. It is low in fertility and very droughty. Under special management, watermelons and other high-value crops can be grown. (Capability unit IVs–1; sewage disposal group 1; irrigation group 1; woodland suitability group 5)

Galestown sand, 2 to 5 percent slopes (GsB).—This soil is like Galestown sand, 0 to 2 percent slopes, except that it is gently sloping. It is low in fertility and very droughty. Under special management, watermelons and other high-value crops can be grown. (Capability unit IVs–1; sewage disposal group 1; irrigation group 1; woodland suitability group 5)

Galestown sand, 5 to 10 percent slopes (GsC).—This soil is generally not suitable for cultivated crops, but it is suited to regulated grazing or to woodland. It can also be used for orchards or for special crops. (Capability unit VIs–1; sewage disposal group 2; woodland suitability group 5)

Galestown sand, 10 to 15 percent slopes (GsD).—Strong slopes, droughtiness, and low fertility make this soil generally unsuitable for cultivation, but it can be used for limited grazing, for woodland, or for wildlife areas. (Capability unit VIIs–1; sewage disposal group 2; woodland suitability group 5)

Galestown sand, 15 to 30 percent slopes (GsE).—This steep, duned soil is northeast of Federalsburg, near the county line. It is so steep and so sandy that it is suitable only for woodland or for wildlife areas. (Capability unit VIIs–1; sewage disposal group 3; woodland suitability group 5)

Johnston Series

The Johnston series consists of very poorly drained, very dark colored soils on flood plains. These soils consist of fairly recent alluvium washed from silty and sandy soils on the uplands. The dark color of the surface layer results from the accumulation of organic matter.

Johnston soils are darker colored, less silty, and more poorly drained than Bibb soils. They resemble Pocomoke and Portsmouth soils but have a thicker surface layer and, commonly, no B horizon.

Soils of the Johnston series are fairly extensive in this county. They are difficult to drain, but the areas that have been drained can be used for most of the crops commonly grown in the area.

Profile of Johnston loam in a drained, cultivated area on the flood plain of Beetree Ditch, about three-fourths of a mile west of Long Marsh Ditch:

A1p—0 to 10 inches, black (10YR 2/1) loam; slightly gritty; weak, fine, crumb structure; friable when moist, nonplastic but slightly sticky when wet; roots abundant; extremely acid; clear, smooth boundary; horizon is 10 to 12 inches thick.

A12—10 to 27 inches, black (5YR 2/1) loam; very weak, medium, blocky structure; somewhat compact; friable to firm when moist; slightly plastic and slightly sticky when wet; roots common in upper part, very few in lower part; extremely acid; abrupt, smooth boundary; horizon is 15 to 20 inches thick.

Cg—27 to 37 inches, dark grayish-brown (2.5Y 4/2) sandy loam or light loam; structureless; very friable when moist, nonplastic and nonsticky when wet; no roots; extremely acid; abrupt, smooth boundary; horizon is 8 to 10 inches thick.

Dg—37 to 50 inches +, light brownish-gray (2.5Y 6/2) loamy sand; structureless; loose; nonplastic and nonsticky; no roots; extremely acid.

The texture of the A horizon varies. In some places the A1 horizon or the entire A horizon is sandy loam. In unplowed areas, particularly forested areas, the upper part of the horizon is likely to be somewhat mucky. The A horizon is 10 to 30 inches thick and is thickest where the texture is finest. In some areas the C horizon is absent and the D horizon is very sandy. In areas where the profile contains a C horizon, the texture of the D horizon is variable. The D1g horizon may be sandy, and a finer textured and more slowly permeable D2g horizon may be within 4 or 5 feet of the surface.

Johnston loam (Jo).—Only one Johnston soil is mapped in the county. Its profile is the one described as representative of the series.

If stream channels are cleaned, straightened, and deepened, this soil can be used for cultivated crops. Lateral ditches may be needed to help drain the wider flood plains. Undrained areas are very wet or even swampy, and most are covered with water-tolerant hardwoods. (Capability unit IIIw–7; drainage group 11A; sewage disposal group 8; woodland suitability group 4)

Klej Series

The Klej series consists of moderately well drained to somewhat poorly drained soils on uplands. These soils show little evidence of textural development and have no B horizon. They formed in beds of sandy material that overlie a substratum of sand, silt, and clay. The lower part of the substratum is mottled.

Klej soils formed in the same kind of material as Galestown, Lakeland, and Plummer soils. They are not so well drained as Galestown and Lakeland soils, but they are better drained than Plummer soils. Klej soils lack the fine-textured B horizon that is typical of Woodstown soils.

Soils of the Klej series are inextensive in the county. They are used for most crops commonly grown in the area.

Profile of Klej loamy sand, 0 to 2 percent slopes, in a cultivated area midway between Todds Chapel and Opossum Hill:

Ap—0 to 7 inches, dark grayish-brown (2.5Y 4/2) loamy sand; very weak, medium, crumb structure; very friable when moist, nonplastic and nonsticky when wet; roots fairly common; strongly acid; abrupt, smooth boundary; horizon is 6 to 9 inches thick.

C1—7 to 14 inches, light brownish-gray (2.5Y 6/2) loamy sand; very weak, fine, crumb to single-grain structure; very friable when moist; roots fairly common; strongly acid; gradual, irregular boundary; horizon is 6 to 12 inches thick.

C2—14 to 34 inches, grayish-brown (2.5Y 5/2) loamy sand; very weak, medium, irregular blocky to single-grain structure; very friable; very few roots; very strongly acid; gradual, irregular boundary; horizon is 12 to 24 inches thick.

C3g—34 to 40 inches, light brownish-gray (2.5Y 6/2) loamy sand; common, fine to medium, distinct mottles of yellowish brown (10YR 5/4); very weak, medium, irregular blocky to single-grain structure; very friable; no visible roots; very strongly acid; abrupt, smooth to slightly wavy boundary; horizon is 4 to 12 inches thick.

Dg—40 to 50 inches +, gray to light-gray (5Y 6/1) compact sandy clay; common, medium, prominent mottles of strong brown (7.5YR 5/6); massive to very weak, coarse, blocky structure; very firm when moist, plastic and sticky when wet; no roots; extremely acid.

In places the plow layer is grayish brown to very dark gray (10YR 5/2 to 10YR 3/1). In unplowed areas, particularly forested areas, the A1 horizon is gray or dark gray. It is 3 to 5 inches thick, and rests directly on the C1 horizon. Mottling may occur at a depth of about 18 or 20 inches, but generally there is little mottling above a depth of 30 inches. The depth to the Dg horizon ranges from 3 to 5 feet.

Klej loamy sand, 0 to 2 percent slopes (KsA).—The profile of this soil is the one described as representative of the series. Included are small areas of soils that are finer textured below the plow layer; these soils have some characteristics of Woodstown soils, but the areas are too small to be mapped separately. In places the Dg horizon is within 2 feet of the surface.

This soil is very sandy, is low in available moisture capacity, and is low to moderate in productivity. Impeded drainage is the main management problem. If adequately drained and fertilized, this soil can be used regularly for cultivated crops. (Capability unit IIIw–10; drainage group 4; sewage disposal group 7; irrigation group 1; woodland suitability group 3)

Klej loamy sand, 2 to 5 percent slopes (KsB).—This soil is very sandy, and it is low to moderate in productivity. The available moisture capacity is low. Impeded drainage is the main management problem, but there is a slight erosion hazard also. If adequately drained, supplied with plant nutrients, and protected against erosion this soil can be used for cultivated crops. (Capability unit IIIw–10; drainage group 4; sewage disposal group 7; irrigation group 1; woodland suitability group 3)

Lakeland Series

The Lakeland series consists of deep, excessively drained and somewhat excessively drained sandy soils that have a fine-textured layer within 4 to 6 feet of the surface. These soils formed in beds of sand or loamy sand on uplands. They are gently sloping or dunelike. They do not have a normally developed profile with a B horizon.

Lakeland soils formed in the same kind of parent material as Klej soils and Plummer soils, but they are better drained. They lack the brown to reddish-brown subsoil that is characteristic of Galestown soils.

Soils of the Lakeland series are not extensive in this county, but they are important locally. They are used for most of the crops grown in the area, particularly for truck crops and sweetpotatoes.

Profile of Lakeland loamy sand, clayey substratum, 5 to 10 percent slopes, in a cultivated and moderately eroded area 2 miles south-southwest of Whiteleysburg and about three-fourths of a mile west of the Delaware State line:

A1p—0 to 10 inches, dark grayish-brown (10YR 4/2) loamy sand; structureless; loose; roots plentiful; strongly acid; clear, smooth boundary; horizon is 8 to 10 inches thick.

A12—10 to 20 inches, light brownish-gray (10YR 6/2) light loamy sand; structureless; loose; roots common; very strongly acid; clear, wavy boundary; horizon is 8 to 10 inches thick.

C1—20 to 29 inches, light yellowish-brown (10YR 6/4) sand; structureless; loose; very few roots; very strongly acid; diffuse boundary; horizon is 8 to 15 inches thick.

C2—29 to 46 inches, brownish-yellow (10YR 6/8) sand; structureless; loose; very few roots; contains some thin bands of yellowish-brown to strong-brown (10YR 5/6 to 7.5YR 5/6), slightly clayey material, probably loamy sand; very strongly acid; gradual, irregular boundary; horizon is 10 to 25 inches thick.

C3—46 to 60 inches, very pale brown (10YR 7/4) sand; structureless; loose; very few roots; a few scattered lumps or bands of slightly clayey material in upper portion; lower portion appears to be permanently moist, even in long dry periods, and may be saturated in normally moist or wet seasons; very strongly acid; abrupt, smooth boundary; horizon is 10 to 20 inches thick.

Dg—60 to 72 inches +, light-gray (2.5Y 7/2) sandy loam blotched and streaked with grayish brown (2.5Y 5/2); massive; friable when moist, sticky and slightly plastic when wet; no roots; appears to be more or less permanently saturated; very strongly acid.

In unplowed areas there is a grayish-brown to dark grayish-brown A11 horizon that is 1 to 4 inches thick. In some areas the C horizon does not contain clayey lumps or bands as in the typical profile. The depth to the Dg horizon is more than 6 feet in some areas.

Lakeland loamy sand, clayey substratum, 0 to 2 percent slopes (LaA).—This soil is low in moisture-supplying capacity and low in productivity. It is suited to the crops commonly grown in the county. Supplemental irrigation and a large amount of fertilizer are needed for good crop yields. The clayey substratum will retain moisture for deep-rooted plants, such as trees. (Capability unit IIIs–1; sewage disposal group 1; irrigation group 1; woodland suitability group 2)

Lakeland loamy sand, clayey substratum, 2 to 5 percent slopes (LaB).—Most of this soil has been eroded by wind and water, but erosion has not caused serious damage. The available moisture capacity is low. This soil can be used for cultivated crops, but it is low in productivity. Supplemental irrigation and a large amount of plant nutrients are needed for good crop yields. The clayey substratum retains moisture for deep-rooted plants. (Capability unit IIIs–1; sewage disposal group 1; irrigation group 1; woodland suitability group 2)

Lakeland loamy sand, clayey substratum, 5 to 10 percent slopes (LaC).—The profile of this soil is the one described as representative of the series. Because of strong slopes, droughtiness, and low productivity this soil is difficult to manage. It is susceptible to erosion. Cultivated crops can be grown occasionally, but the choice of crops is limited. (Capability unit IVs–1; sewage disposal group 2; irrigation group 1; woodland suitability group 2)

Lakeland sand, clayey substratum, 2 to 10 percent slopes (LcC).—This soil is less suitable for agriculture than the Lakeland loamy sands, because of its coarser texture. It is, however, suitable for watermelons, sweetpotatoes, and other special crops, if erosion is controlled. (Capability unit IVs–1; sewage disposal group 2; irrigation group 1; woodland suitability group 5)

Made Land

Made land (Ma).—A few small areas in this county have been so changed by human activities that they can no longer be identified by soil type or soil series. These are areas on which fill material has been deposited, or from which soil material has been removed as the result of leveling operations.

This land type is so varied that an on-site examination is necessary before interpretations are made for specific uses. Most of the areas have no agricultural use.

Matapeake Series

The Matapeake series consists of deep, well-drained soils on uplands. These soils developed in silty material, probably loess, that overlies a sandy substratum. Generally, the silty material contains some fine sand and very fine sand.

Matapeake soils are similar to Sassafras soils but are less sandy. Sassafras soils have a subsoil of sandy clay loam; Matapeake soils have a subsoil of heavy silt loam to silty clay loam. Matapeake soils developed in the same kind of material as the moderately well drained Mattapex soils, the poorly drained Othello soils, and the very poorly drained Portsmouth soils.

Soils of the Matapeake series are inextensive, but they are among the most productive and most important agricultural soils in the county.

Profile of Matapeake silt loam, 2 to 5 percent slopes, moderately eroded, in a cultivated area about one-eighth mile west of the intersection of Poplar Neck Road and Marsh Road, about 2 miles northwest of Choptank:

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, medium, crumb structure; friable when moist, nonplastic but slightly sticky when wet; roots abundant; slightly acid to neutral (limed); clear, smooth boundary; horizon is 8 to 10 inches thick.

B21—9 to 19 inches, yellowish-brown (10YR 5/4) light silty clay loam; moderate, fine to medium, subangular blocky structure; friable when moist, slightly plastic and slightly sticky when wet; roots rather plentiful; medium acid; gradual, smooth boundary; horizon is 8 to 12 inches thick.

B22—19 to 37 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate to strong, medium, blocky structure; rather firm when moist, moderately plastic and moderately sticky when wet; roots fairly common; almost continuous clay skins on blocks and some heavy, thick clay flows between blocks; strongly acid; abrupt, wavy boundary; horizon is 15 to 24 inches thick.

Dg—37 to 48 inches +, grayish-brown (2.5Y 5/2), compact heavy sandy loam; common, medium, distinct mottles of yellowish brown (10YR 5/6) and few, medium, prominent mottles of strong brown (7.5YR 5/8); massive; moderately firm when moist, slightly plastic and slightly sticky when wet; a few scattered fine roots; strongly to very strongly acid.

In unplowed and uneroded areas, which are generally forested, there is a thin, dark-brown to very dark grayish-brown A1 horizon over a yellowish-brown A2 horizon. The A horizon has a crumb structure and is coarser in texture than the B horizon. The A and B horizons ordinarily contain some fine sand or very fine sand. The sand in the D horizon is coarser. In some areas the D horizon contains less sand and more silt than in the profile described. In spots there is little or no mottling in the D horizon.

Matapeake silt loam, 0 to 2 percent slopes (MkA).—This soil has been damaged very little if at all by erosion. It ordinarily has, just above the B21 horizon, a thin A2 horizon of yellowish-brown silt loam that has a medium crumb structure. The available moisture capacity is high. Under good management, this soil is very productive. It is one of the most important agricultural soils in the county. It is suited to the crops commonly grown in the county. (Capability unit I–4; sewage disposal group 1; irrigation group 4; woodland suitability group 1)

Matapeake silt loam, 2 to 5 percent slopes, moderately eroded (MkB2).—The profile of this soil is the one described as representative of the series. The available moisture capacity is high. Under good management, this soil is productive. It can be cultivated safely but needs conservation measures for the control of erosion. It is well suited to crops, pasture, or trees. (Capability unit IIe–4; sewage disposal group 1; irrigation group 4; woodland suitability group 1)

Matapeake silt loam, 15 to 30 percent slopes (MkE).—This soil is not eroded, but it is too steep to be cultivated safely. If carefully managed, it can be used for pasture.

It is an excellent soil for pine and hardwood trees. Forested areas should not be cleared. (Capability unit VIe–2; sewage disposal group 3; woodland suitability group 1)

Mattapex Series

The Mattapex series consists of deep, moderately well drained soils that developed in silty material over a sandy substratum. The subsoil is mottled and compact and has a platy structure. It resembles a weak siltpan or fragipan.

Mattapex soils developed in the same kind of material as the well-drained Matapeake soils, the poorly drained Othello soils, and the very poorly drained Portsmouth soils. Mattapex soils are less brown than Matapeake soils. They resemble Woodstown soils, but their subsoil is silty clay loam instead of sandy clay loam, and they are more silty throughout.

Mattapex soils are not extensive in this county. They occur mainly in the southwestern part, near Choptank. These soils are often wet for considerable periods of time, and they are slow to warm up in spring. Perennial crops, such as alfalfa, are likely to be damaged by winter heaving, and planting of annual crops is often delayed. Nevertheless, these soils are important to agriculture in the part of the county in which they occur.

Profile of Mattapex silt loam, 0 to 2 percent slopes, in a cultivated area on Marsh Road, about 1½ miles northwest of Choptank:

Ap—0 to 10 inches, grayish-brown (2.5Y 5/2), very slightly gritty silt loam; moderate, medium, crumb structure; friable when moist; nonplastic but slightly sticky when wet; roots abundant; medium acid to strongly acid; clear, smooth boundary; horizon is 10 to 12 inches thick.

B21—10 to 24 inches, light olive-brown (2.5Y 5/6) light silty clay loam; moderate, medium, blocky and subangular blocky structure; friable to somewhat firm when moist, slightly plastic and moderately sticky when wet; roots common; strongly acid; clear, slightly wavy boundary; horizon is 10 to 15 inches thick.

B22g—24 to 35 inches, grayish-brown (2.5Y 5/2), slightly gritty silty clay loam; abundant, medium, prominent mottles of strong brown (7.5YR 5/6); compound weak, coarse, platy and moderate, fine to medium, blocky structure; firm and somewhat brittle when moist; moderately plastic and moderately sticky when wet; very few roots; strong-brown (7.5YR 5/6), scattered but thick clay skins on some blocks and plates; very strongly acid; gradual, smooth boundary; horizon is 8 to 12 inches thick.

D1g—35 to 49 inches, light brownish-gray (2.5Y 6/2), compact sandy loam; abundant, medium, distinct mottles of yellowish brown (10YR 5/4) and few, medium, prominent mottles of strong brown (7.5YR 5/6); massive to very weak, very coarse, platy structure; very firm when moist, slightly plastic and slightly sticky when wet; no roots; very strongly acid; clear to abrupt, smooth boundary; horizon is 10 to 14 inches thick.

D2g—49 to 60 inches +, light olive-gray (5Y 6/2) loamy sand or light sandy loam; common, medium, prominent mottles of yellowish brown (10YR 5/4); no structure; very friable when moist, nonplastic but very slightly sticky when wet; no roots; very strongly acid.

In unplowed areas or forested areas there is a thin, dark-gray A1 horizon and a somewhat thicker yellowish-brown or light olive-brown A2 horizon. These horizons have a crumb structure and are not so fine textured as the B horizons. In places the B21 horizon is yellowish brown (10YR 5/4 or 5/6).

Mattapex silt loam, 0 to 2 percent slopes (MsA).—The profile of this soil is the one described as representative of the series. This soil is wet during the planting season and early in the growing season. Removing the excess water during those seasons is the main management problem. If adequately drained this soil is suited to most crops commonly grown in the county. (Capability unit IIw–1; drainage group 2A; sewage disposal group 7; irrigation group 4; woodland suitability group 1)

Mattapex silt loam, 2 to 5 percent slopes, moderately eroded (MsB2).—Runoff has caused the loss of some of the original surface layer of this soil. If adequately drained and protected against erosion, this soil is suited to most crops commonly grown in the county. (Capability unit IIe–16; drainage group 2A; sewage disposal group 7; irrigation group 4; woodland suitability group 1)

Mattapex silt loam, 15 to 30 percent slopes (MsE).—This soil is mostly in forest and, consequently, is practically uneroded. It should remain forested. It is suitable for use as wildlife areas. Because of the slope, this soil is not suitable for cultivation. Some areas can be used for pasture if carefully managed. (Capability unit VIe–2; sewage disposal group 7; woodland suitability group 1)

Mixed Alluvial Land

This land type consists of mixed soil material on flood plains. The texture of the surface layer ranges from sand or loamy sand to loam or silt loam within short distances. The color ranges from light gray to dark gray or black, depending on the amount of organic matter that has accumulated. In most areas drainage is poor, but included are some areas that are better drained. Because of the many variations within short distances, these soils are not separated into types.

Mixed alluvial land (Mt).—Because this land type is so varied, is commonly wet, and is subject to yearly flooding, it is little used for agriculture. It is not suited to cultivated crops, but it has limited use for pasture. (Capability unit VIw–1; drainage group 12; sewage disposal group 8; woodland suitability group 4)

Muck

Muck consists largely of almost completely decomposed organic material that has accumulated in poorly drained areas. The organic-matter content ranges from 30 percent to 60 percent or more.

Muck has formed in small depressions and along swampy waterways in the southeastern part of Caroline County. The organic matter consists of the remains of white bay, black gum, pond pine, sedges, grasses, and many wetland herbs and shrubs. Most of the acreage is wooded.

Profile of Muck in a swamp forest south of Marshyhope Creek and about 1 mile southeast of Smithville:

0 to 3 inches, black (10YR 2/1), slightly sandy muck, mostly highly decomposed but containing some visible remnants of leaves and twigs; somewhat fibrous; slightly sticky but nonplastic when wet; roots abundant; extremely acid; gradual, smooth boundary; horizon is 2 to 4 inches thick.

3 to 24 inches, black (10YR 2/1) muck, consisting of highly decomposed organic material, very fine and amorphous, with some mixture of fine mineral material; plastic and sticky when wet; roots abundant in upper portion and

fairly common throughout; extremely acid; abrupt, wavy boundary; horizon is 15 to 40 or more inches thick.

34 to 50 inches +, light olive-gray (5Y 6/2) loamy sand of low density; structureless; loose; waterbearing; a few, coarse, woody roots; extremely acid.

The depth to the underlying sand and mineral material ranges from 18 to 50 inches or more. Ordinarily, Muck is thickest near the center of an area and thinnest at the edges of the area.

Muck (Mu).—This is the only organic soil in Caroline County. It is of little use for agriculture. It is very wet, and it shrinks if drained. If cleared and drained, Muck can be used for a special crop, such as blueberries. Most of the acreage is wooded and should remain so. (Capability unit VIIw–1; drainage group 9–7; sewage disposal group 8)

Othello Series

The Othello series consists of poorly drained soils on uplands. These soils developed in silty deposits over beds of sand, sandy loam, and sandy clay.

Othello soils formed in the same kind of material as Matapeake, Mattapex, and Portsmouth soils. They are more poorly drained than Matapeake and Mattapex soils but are better drained than Portsmouth soils. Othello soils are similar to Elkton and Fallsington soils, but Elkton soils developed in silty and clayey material and Fallsington soils in more sandy material.

Soils of the Othello series are inextensive in this county but are important locally. They are not difficult to drain. The areas that have been drained can be used for most of the crops commonly grown in the area.

Profile of Othello silt loam in an idle but recently cultivated area about 3½ miles south of Bethlehem:

Ap—0 to 8 inches, dark grayish-brown (2.5Y 4/2) silt loam; common, very fine, distinct specks of dark red (2.5YR 3/6); *moderate*, medium, crumb structure; friable when moist; strongly acid; abrupt, smooth boundary; horizon is 7 to 10 inches thick.

B2g—8 to 21 inches, gray (10YR 5/1) light silty clay loam; common, coarse, prominent mottles of strong brown (7.5YR 5/8); moderate, medium, subangular blocky structure; very firm when moist, moderately plastic and sticky when wet; roots common; *very strongly* acid to extremely acid; gradual, wavy boundary; horizon is 10 to 14 inches thick.

B3g—21 to 26 inches, gray to light-gray (5Y 6/1) fine sandy loam; many, coarse, prominent mottles of strong brown (7.5YR 5/8); weak, medium, subangular blocky structure; firm when moist, slightly plastic and slightly sticky when wet; a few fibrous roots; very strongly acid; *gradual, wavy* boundary; horizon is 4 to 8 inches thick.

Dg—26 to 36 inches +, gray to light-gray (5Y 6/1) sand; structureless; loose; waterbearing; common, coarse, faint mottles of olive gray (5Y 5/2) and common, coarse, prominent mottles of strong brown (7.5YR 5/8); very strongly acid to extremely acid.

Forested areas have a thin, dark-gray A1 horizon and a moderately thick, gray or light-gray A2 horizon, both of silt loam and both having a fine or medium crumb structure.

Othello silt loam (Oh).—This is the only Othello soil in Caroline County. Its profile is the one described as representative of the series. It is level or nearly so. Drainage is the main problem in managing this soil. Adequate drainage makes it suitable for all the crops commonly grown in the county. (Capability unit IIIw–7; drainage group 8–1A; sewage disposal group 7; woodland suitability group 8)

Plummer Series

The Plummer series consists of poorly drained soils in depressions and other low-lying areas, mostly near the large streams. These soils developed in sandy material. Some organic matter has accumulated in the surface layer, and as a result, this layer is dark gray. No B horizon has developed. In many places the light-colored sandy substratum is streaked or splotched with gray or brown. Although very rapidly permeable, Plummer soils have a high water table except in periods of extreme drought.

Plummer soils developed in the same kind of material as the moderately well drained Klej soils and the excessively drained or somewhat excessively drained Galestown and Lakeland soils.

Plummer soils occur as small, scattered areas in the more sandy areas of Caroline County. In undrained areas, the water table is at or near the surface during most of the year, and in some places water stands on the surface for long periods. These soils are very strongly acid or extremely acid. They are not very productive and are generally of little importance to agriculture.

Profile of Plummer loamy sand in a forested area half a mile south of Hillsboro and about a quarter of a mile east of Tuckahoe Creek:

A1—0 to 6 inches, dark-gray (10YR 4/1) light loamy sand; structureless; nearly loose; roots plentiful; very strongly acid; clear, smooth boundary; horizon is 5 to 6 inches thick.

C1g—6 to 14 inches, light brownish-gray (2.5Y 3/2) light loamy sand; structureless; loose; very few roots; extremely acid; gradual, irregular boundary; horizon is 6 to 12 inches thick.

C2g—14 to 48 inches +, light-gray (5Y 7/2) fine sand, grading downward to white (5Y 3/2); some streaks and splotches of grayish brown (2.5Y 3/2) in lower portion; loose; no roots; waterlogged or quick condition (tending to flow when saturated) in lower portion; extremely acid.

In cultivated areas the plow layer is commonly light gray, but it is almost white when it has dried after a rain. Some small areas have a weakly developed B horizon of very light sandy loam. Locally, the substratum is gray (5Y 5/1 or 6/1), and in some places the lower part is mottled or blotched with brown or yellowish brown (10 YR 5/3 or 5/4).

Plummer loamy sand (Pm).—Most of this soil is nearly level, but about 40 acres has a slope of 2 percent or slightly more. The profile is the one described as representative of the series.

Drainage is the main management problem. Drainage is likely to be difficult and expensive; nevertheless, some areas, including one just south of the Pennsylvania Railroad tracks in Federalsburg, have been drained. Drained areas are used to some extent for truck crops and corn but mostly for home gardens. Gardens are fairly productive if heavily fertilized and otherwise well managed. (Capability unit IVw–6; drainage group 9–1; sewage disposal group 7; woodland suitability group 3)

Pocomoke Series

The Pocomoke series consists of very poorly drained soils that have developed in beds of unconsolidated sandy and silty material of the Coastal Plain. These soils have a black or nearly black, moderately coarse textured to medium textured surface layer, a subsoil of heavy sandy loam to sandy clay loam, and a sandier substratum.

Pocomoke soils developed in about the same kind of material as the well drained Sassafras soils, the moderately well drained Woodstown soils, and the poorly drained Fallsington soils. The profile of Pocomoke soils resembles that of Portsmouth soils, but Pocomoke soils developed in coarser textured material. Pocomoke soils are similar to Johnston soils, but they have a distinct B horizon, which Johnston soils lack.

Soils of the Pocomoke series are extensive in this county. If drained, they can be used for most of the crops commonly grown in the area.

Profile of Pocomoke loam in a loblolly pine forest about 3 miles east of Chapel Bridge:

A1—0 to 11 inches, black (10YR 2/1) loam; weak, medium, crumb structure; friable when moist, sticky and slightly plastic when wet; roots plentiful; extremely acid; abrupt, smooth boundary; horizon is 10 to 12 inches thick.

B21g—11 to 23 inches, dark-gray (5Y 4/1) sandy clay loam; weak, medium, blocky and subangular blocky structure; firm when moist, plastic and sticky when wet; roots few to common; extremely acid; gradual, smooth boundary; horizon is 10 to 14 inches thick.

B22g—23 to 31 inches, gray (5Y 5/1) sandy clay loam; few, medium, distinct mottles of grayish brown (10YR 5/2) and few, medium, faint mottles of light gray (N 6/0); weak, coarse, blocky structure; firm when moist, plastic and sticky when wet; very few roots; some clay flows of grayish brown (10YR 5/2) in old root channels; extremely acid; abrupt, smooth boundary; horizon is 6 to 8 inches thick.

Dg—31 to 48 inches +, gray to light-gray (N 6/0) very light sandy loam or heavy loamy sand; few, medium, faint mottles of gray (10YR 6/1); a few gray (5Y 5/1) clay flows in old root channels; loose to very friable; a few woody roots; extremely acid.

In cultivated areas the surface layer is dark gray or very dark gray and is lower in organic matter than in uncultivated areas. The texture of the surface layer ranges from sandy loam to loam. Where the surface layer is sandy loam, the B horizon is very heavy sandy loam or light sandy clay loam. In areas where the surface layer is loam, the B horizon is heavy sandy clay loam. In some areas the B21g and B22g horizons have yellowish-brown to strong-brown mottles.

Pocomoke loam (Po).—This is the most extensive Pocomoke soil in the county. Most of it is nearly level, but a few acres have a slope of a little more than 2 percent. The profile is the one described as representative of the series. Drainage is the main management problem. Adequate drainage makes it possible to grow crops commonly grown in the county. Under good management, this soil is productive. (Capability unit IIIw–7; drainage group 9–3A; sewage disposal group 7; woodland suitability group 3)

Pocomoke sandy loam (Ps).—Because it is somewhat sandier throughout, this soil is easier to drain and easier to work than Pocomoke loam. If drained, it is suited to most of the crops commonly grown in the county. It is productive under good management, though its available moisture capacity is not quite so high as that of Pocomoke loam. Included are a few acres that have a slope of more than 2 percent. (Capability unit IIIw–6; drainage group 9–3B; sewage disposal group 7; woodland suitability group 3)

Portsmouth Series

The Portsmouth series consists of very poorly drained soils that have a dark-gray to black surface layer. These soils developed in very silty material over sandy deposits of the Coastal Plain.

Portsmouth soils formed in the same kind of material as the well drained Matapeake soils, the moderately well drained Mattapex soils, and the poorly drained Othello soils. Portsmouth soils are similar to Pocomoke soils, but their surface layer and subsoil are finer textured and they are more difficult to drain. They are less wet then Bayboro soils and are less fine textured in the subsoil.

Soils of the Portsmouth series occupy a small acreage in this county. If adequately drained and properly limed and fertilized, they are good for agriculture.

Profile of Portsmouth silt loam in a pasture about 2 miles west-southwest of Mount Zion:

Ap—0 to 8 inches, black (5Y 2/2) silt loam; weak, medium, crumb structure; friable when moist, sticky and slightly plastic when wet; roots plentiful; high organic-matter content; very strongly acid; abrupt, smooth boundary; horizon is 7 to 8 inches thick.

B21g—8 to 18 inches, olive-gray (5Y 5/2) silty clay loam; few, fine, prominent mottles of yellowish brown (10YR 5/4); weak, medium, blocky and subangular blocky structure; firm when moist, plastic and sticky when wet; roots common in upper portion, fewer below; very strongly acid; gradual, smooth to diffuse boundary; horizon is 9 to 14 inches thick.

B22g—18 to 26 inches, olive-gray (5Y 5/2) light silty clay; common, fine and medium, distinct mottles of brown (10YR 4/3); very weak, coarse, blocky structure; firm when moist, very plastic and very sticky when wet; practically no roots; some distinct, fine and medium sand grains; extremely acid; abrupt, slightly wavy boundary; horizon is 6 to 8 inches thick.

D1g—26 to 44 inches, pale-olive (5Y 6/5) loamy sand to light sandy loam; few, thin, horizontal streaks of brown (10YR 6/3) and olive yellow (5Y 6/6); structureless; loose to very friable; no roots; extremely acid; abrupt, smooth boundary; horizon is 15 to 20 inches thick.

D2g—44 to 60 inches +, light-gray (5Y 7/2) fine sandy clay loam to fine sandy clay; few, thin, distinct, horizontal streaks of olive yellow (5Y 6/6); massive; very firm when moist, plastic and sticky when wet; no roots; very strongly acid to extremely acid.

In wooded areas the A1 horizon is somewhat thicker than the Ap horizon described in the profile. In both wooded areas and cultivated areas the surface layer may be very dark gray instead of black. The surface layer is very mucky in some undisturbed areas. In some places the B22g horizon is slightly finer textured. In some spots there is a thin B3g horizon of sandy clay loam or heavy sandy loam between the B22g and D1g horizons.

Portsmouth silt loam (Pt).—The profile of this soil is the one described as representative of the series. This is the only Portsmouth soil in the county. Because this soil is difficult to drain, most of the acreage is wooded. Small, scattered areas are used for pasture or for cultivated crops or are idle. If adequately drained and properly managed,

this soil can be used regularly for cultivated crops. (Capability unit IIIw–7; drainage group 9–4A; sewage disposal group 7; woodland suitability group 3)

Sassafras Series

The Sassafras series consists of deep, well-drained soils on uplands. These soils developed in marine deposits of sand, silt, and clay. They are characterized by a well-developed subsoil that is yellowish brown to brown in color and is finer in texture than the surface layer.

Sassafras soils are similar to Matapeake soils, but they have more sand in the A and B horizons. They developed in the same kind of material as the moderately well drained Woodstown soils, the poorly drained Fallsington soils, and the very poorly drained Pocomoke soils.

Sassafras soils are the most extensive in Caroline County. They are good agricultural soils. They need no drainage but would benefit from irrigation.

Profile of Sassafras sandy loam, 2 to 5 percent slopes, moderately eroded, in a cultivated area 1½ miles southwest of the intersection of Poplar Neck Road and State Route No. 331:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) sandy loam; weak, fine, crumb structure; very friable when moist, nonplastic and nonsticky when wet; roots abundant; strongly acid; abrupt, smooth boundary; horizon is 6 to 7 inches thick.

B21—6 to 14 inches, yellowish-brown (10YR 5/4) light sandy clay loam; moderate, fine to medium, subangular blocky structure; friable when moist, nonplastic but slightly sticky when wet; roots common; medium acid to strongly acid; gradual, wavy boundary; horizon is 8 to 10 inches thick.

B22—14 to 33 inches, yellowish-brown (10YR 5/6) sandy clay loam; moderate, medium, blocky structure; friable to somewhat firm when moist, moderately plastic and moderately sticky when wet; roots fairly common; almost continuous, thin, self-colored clay skins on blocks; very strongly acid; clear, wavy boundary; horizon is 15 to 20 inches thick.

C1—33 to 40 inches, yellowish-brown (10YR 5/4) sandy loam; massive to very weak, very coarse, blocky structure; friable when moist, nonplastic but slightly sticky when wet; very few roots; few prominent clay flows of dark brown (7.5YR 4/4); very strongly acid; gradual, wavy boundary; horizon is 5 to 10 inches thick.

C2—40 to 50 inches +, yellowish-brown (10YR 5/4) loamy sand; single grain; very friable when moist, nonplastic and nonsticky when wet; no visible roots; very strongly acid.

In uneroded areas there is a grayish-brown (2.5Y 5/2) A2 horizon a few inches thick, and the B21 horizon is 10 inches or more in thickness. In forested areas there is ordinarily a dark-colored A1 horizon 3 or 4 inches thick and an A2 horizon 6 to 10 inches thick. Locally the subsoil is strong brown or reddish brown.

Sassafras sandy loam, 0 to 2 percent slopes (SnA).—This is the most extensive of the Sassafras soils in this county. It is one of the better agricultural soils and is important to the economy of the county. It has a thick surface layer, and it is easy to work and to manage. The sandy surface layer holds less available moisture than the subsoil, but if ordinary good farming methods are used this soil can be cultivated regularly. (Capability unit I–5; sewage disposal group 1; irrigation group 3; woodland suitability group 2)

Sassafras sandy loam, 2 to 5 percent slopes (SnB).—This soil is not eroded, but it is susceptible to erosion. Some areas have slopes that are irregular. The sandy surface layer is easier to work and to manage than the firmer and finer textured subsoil, but it holds less available moisture for plant use. If erosion is controlled this soil can be cultivated regularly. (Capability unit IIe–5; sewage disposal group 1; irrigation group 3; woodland suitability group 2)

Sassafras sandy loam, 2 to 5 percent slopes, moderately eroded (SnB2).—This soil is extensive and is important agriculturally. Its profile is the one described as representative of the series. If erosion is controlled this soil can be cultivated regularly and used for most of the crops commonly grown in the county. Some areas have irregular slopes, small depressions, and wet spots, and consequently are not suitable for contour farming. (Capability unit IIe–5; sewage disposal group 1; irrigation group 3; woodland suitability group 2)

Sassafras sandy loam, 2 to 5 percent slopes, severely eroded (SnB3).—Erosion has removed most of the surface layer of this soil, and normal plowing will turn up much of the subsoil. If cultivated regularly, this soil needs to be managed intensively and protected from further erosion. It should be stripcropped and tilled on the contour. Close-growing crops should be grown in long rotations. (Capability unit IIIe–5; sewage disposal group 1; woodland suitability group 2)

Sassafras sandy loam, 5 to 10 percent slopes (SnC).—Although this soil has stronger slopes than Sassafras sandy loam, 2 to 5 percent slopes, moderately eroded, it has been less damaged by erosion. The hazard of erosion is serious, however, so this soil needs intensive management if it is cultivated regularly. It should be stripcropped and tilled on the contour. Close-growing crops should be grown in long rotations. (Capability unit IIIe–5; sewage disposal group 2; irrigation group 3; woodland suitability group 2)

Sassafras sandy loam, 5 to 10 percent slopes, moderately eroded (SnC2).—This soil is more severely eroded than Sassafras sandy loam, 5 to 10 percent slopes. If cultivated regularly, it needs to be protected from further erosion by stripcropping, contour tillage, and long rotations consisting mainly of close-growing crops. (Capability unit IIIe–5; sewage disposal group 2; irrigation group 3; woodland suitability group 2)

Sassafras sandy loam, 5 to 10 percent slopes, severely eroded (SnC3).—This soil has lost most of its original surface layer through erosion, and normal plowing will turn up much of the subsoil. Cultivated crops can be grown only to a limited extent. Either permanent sod or a long rotation consisting mainly of close-growing crops should be used. (Capability unit IVe 5; sewage disposal group 2; woodland suitabilty group 2)

Sassafras sandy loam, 10 to 15 percent slopes (SnD).—This soil is practically uneroded because most of it is still forested. The slope is strong enough so that erosion could become a serious hazard if the soil is cultivated. This soil can be used only to a limited extent for cultivated crops, or it can be used for sodded orchards, pasture, woodland, or wildlife areas. Long rotations that include only an occasional cultivated crop should be used. (Capability unit

IVe–5; sewage disposal group 2; woodland suitability group 2)

Sassafras sandy loam, 10 to 15 percent slopes, moderately eroded (SnD2).—Although part of its surface layer has been removed by erosion, this strongly sloping soil can be cultivated to a limited extent. Long rotations that include only an occasional cultivated crop should be used. This soil can also be used for woodland, wildlife areas, and sodded orchards. (Capability unit IVe–5; sewage disposal group 2; woodland suitability group 2)

Sassafras sandy loam, 15 to 30 percent slopes (SnE).—Because of the steep slope and the resulting erosion hazard, this soil is generally not suitable for cultivated crops. It is suitable for sod crops, sodded orchards, wildlife areas, or woodland. (Capability unit VIe–2; sewage disposal group 3; woodland suitability group 2)

Sassafras sandy loam, 30 to 60 percent slopes (SnF).—This soil occupies narrow, steep slopes along ravines. Included are some small areas in which the surface layer is more sandy. Because of the erosion hazard, this soil should not be cultivated. It can be used for limited grazing, for woodland, or for wildlife areas. Wooded areas should not be cleared. (Capability unit VIIe–2; sewage disposal group 3; woodland suitability group 2)

Sassafras sandy loam, heavy substratum, 0 to 2 percent slopes (SsA).—This is an excellent soil for agriculture. It has a substratum of sandy clay or sandy clay loam. Because of this finer textured substratum, the moisture-supplying capacity is higher than that of the normal Sassafras sandy loam phase. This soil can be used regularly for most of the crops commonly grown in the county. (Capability unit I–5; sewage disposal group 1; irrigation group 3; woodland suitability group 2)

Sassafras sandy loam, heavy substratum, 2 to 5 percent slopes (SsB).—Although there is some hazard of erosion, this soil can be cultivated if carefully managed. The sandy surface layer is easy to work. Stripcropping, contour tillage, and rotations consisting of close-growing crops will help to control erosion. (Capability unit IIe-5; sewage disposal group 1; irrigation group 3; woodland suitability group 2)

Sassafras loam, 0 to 2 percent slopes (SaA).—The upper horizons of this soil are thicker than those in the profile described, and the entire profile is deeper to the substratum. This soil retains moisture better and is likely to be slightly more productive than the Sassafras soils that have a surface layer of sandy loam, but it is slightly harder to work and to manage. It can be cultivated regularly if carefully managed. It is suited to most of the crops commonly grown in the county. (Capability unit I–4; sewage disposal group 1; irrigation group 4; woodland suitability group 1)

Sassafras loam, 2 to 5 percent slopes, moderately eroded (SaB2).—This soil is like Sassafras loam, 0 to 2 percent slopes, except that it has stronger slopes and is moderately eroded. It retains moisture and is productive, but, if cultivated regularly, it needs careful management to control further erosion. Most of the acreage has smooth, regular slopes and can be farmed on the contour. A small acreage that has irregular or hummocky slopes and many small depressions is unsuitable for contour farming. (Capability unit IIe–4; sewage disposal group 1; irrigation group 4; woodland suitability group 1)

Sassafras loam, heavy substratum, 0 to 2 percent slopes (ShA).—This soil is like Sassafras loam, 0 to 2 percent slopes, except that it has a substratum of sandy clay or sandy clay loam instead of loamy sand. Because of this finer textured substratum, this soil has more moisture-storing capacity and will supply moisture to crops for longer periods in unusually dry seasons.

If carefully managed, this soil is productive. It can be cultivated regularly and is suited to most crops commonly grown in the county. (Capability unit I–4; sewage disposal group 1; irrigation group 4; woodland suitability group 1)

Sassafras loamy sand, 0 to 2 percent slopes (SmA).—This soil is fairly extensive and is important in the agriculture of the county.

Profile of Sassafras loamy sand, 0 to 2 percent slopes, in a cultivated area on Providence Landing Road, about 1½ miles northeast of Tanyard:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) loamy sand; loose; single grain; roots plentiful; strongly acid; clear, smooth boundary; horizon is 7 to 10 inches thick.

A2—10 to 20 inches, grayish-brown (2.5Y 5/2) loamy sand; single grain; loose to very friable; roots common; very strongly acid; clear, smooth boundary; horizon is 6 to 10 inches thick.

B1—20 to 26 inches, yellowish-brown (10YR 5/4) sandy loam; very weak, medium, subangular blocky structure; friable when moist, nonplastic but slightly sticky when wet; roots rather common; very strongly acid; gradual, wavy boundary; horizon is 2 to 6 inches thick.

B2—26 to 32 inches, strong-brown (7.5YR 5/6) sandy clay loam; moderate, medium to course, blocky structure; friable to somewhat firm when moist, slightly plastic and sticky when wet; few roots; irregular, discontinuous, self-colored clay skins; very strongly acid; clear, irregular boundary; horizon is 4 to 8 inches thick.

C—32 to 50 inches +, light yellowish-brown (10YR 6/4) loamy sand; structureless; loose; very few roots; contains some very small inclusions of material similar to that of the Bg horizon; very strongly acid.

In undisturbed areas there is a dark-brown or dark grayish-brown A1 horizon. It averages 2 inches in thickness and ranges from 1 to 6 inches. It is underlain by an A2 horizon that extends to a depth of 18 to 24 inches. The B2 horizon is seldom more than 8 or 10 inches thick. In some places the B2 horizon is redder or more yellowish than that of the profile described. The C horizon is sand or loamy sand and in places contains some fine cherty gravel. In some places a D horizon, finer textured than the C horizon, is within 5 or 6 feet of the surface.

This soil has a thicker and coarser textured surface layer than either Sassafras sandy loam or Sassafras loam. It is easier to work and warms up more quickly in the spring. Because it is more sandy, it does not hold as much available moisture. Supplemental irrigation is beneficial during periods of dry weather. If well managed and adequately fertilized, this soil is well suited to early vegetable crops. (Capability unit IIs–4; sewage disposal group 1; irrigation group 2; woodland suitability group 2)

Sassafras loamy sand, 2 to 5 percent slopes (SmB).—Erosion is a slight hazard, but sandiness and droughtiness are the main management problems on this soil. There is a small acreage that is not suitable for contour tillage because of irregular slopes and wet spots. The sandiness of the surface layer reduces the amount of moisture available for plant use. Supplemental irrigation is very bene-

ficial during periods of dry weather. This soil is well suited to early vegetable crops if adequately supplied with plant nutrients and protected against erosion. (Capability unit IIs–4; sewage disposal group 1; irrigation group 2; woodland suitability group 2)

Sassafras loamy sand, 2 to 5 percent slopes, moderately eroded (SmB2).—This soil is thinner than the representative soil described. The B horizon is at a depth of 10 to 12 inches. A few acres have very irregular slopes and are not suitable for contour tillage. The sandiness of the surface layer reduces the supply of moisture available for plant use. Supplemental irrigation is very beneficial during periods of dry weather. This soil is well suited to early vegetable crops if adequately supplied with plant nutrients and protected against erosion. (Capability unit IIs–4; sewage disposal group 1; irrigation group 2; woodland suitability group 2)

Sassafras loamy sand, 5 to 10 percent slopes (SmC).—This soil is not significantly eroded, but because of the slope there is always a hazard of erosion. The low moisture-supplying capacity of the surface layer and the hazard of erosion increases the need for good management if this soil is cultivated regularly. Stripcropping, contour tillage, and a long rotation consisting of close-growing crops will help to control erosion. Supplemental irrigation would be beneficial in dry seasons, but it may not be practical. (Capability unit IIIe–33; sewage disposal group 2; irrigation group 2; woodland suitability group 2)

Sassafras loamy sand, 5 to 10 percent slopes, moderately eroded (SmC2).—This soil has lost part of the original surface layer through erosion. The present surface layer has a low moisture-supplying capacity. If cultivated, this soil needs to be protected against further erosion by special management practices, such as stripcropping, contour tillage, and long rotations consisting largely of close-growing crops. (Capability unit IIIe–33; sewage disposal group 2; irrigation group 2; woodland suitability group 2)

Sassafras loamy sand, 5 to 10 percent slopes, severely eroded (SmC3).—This soil has lost much of its original surface layer through erosion, and the present plow layer consists of material that was formerly part of the subsoil. This soil can be used occasionally for cultivated crops, but very careful management is needed to control further erosion. The surface layer is low in moisture-supplying capacity, and the strong slope may make irrigation impractical. (Capability unit IVe–5; sewage disposal group 2; woodland suitability group 2)

Sassafras loamy sand, 10 to 15 percent slopes (SmD).—Erosion has caused no serious damage to this soil, but the slope is strong enough so that erosion could become a serious problem. If well managed, this soil can be used occasionally for cultivated crops. The surface layer is low in moisture-supplying capacity, and, because of the strong slope, irrigation may not be practical. (Capability unit IVe–5; sewage disposal group 2; woodland suitability group 2)

Sassafras loamy sand, 15 to 30 percent slopes (SmE).—This soil is not appreciably eroded, because most of it is forested. If cleared it is extremely erodible, so it is generally not suitable for cultivation. It can be used safely for sodded orchards, woodland, wildlife areas, and, if grazing is limited, for pasture. (Capability unit VIe–2; sewage disposal group 3; woodland suitability group 2)

Swamp

This land type consists of unclassified soil material. All of the areas are subject to overflow from fresh-water streams. They are difficult to drain and are under water a large part of the year.

Swamp (Sw).—The Swamp areas of Caroline County are composed of silt, clay, muck, peat, or a mixture of these. They are not used for agriculture. Some areas can be used for wetland forest and to provide food and cover for wildlife. (Capability unit VIIw–1; sewage disposal group 8)

Tidal Marsh

This land type consists of areas that are flooded periodically by tidal waters. The soil material is of many different textures. These areas are too wet and too brackish to be used for agriculture.

Tidal marsh (Tm).—The soil material in these salt marshes ranges in texture from sand to clay. Some areas consist of muck. Included are some areas that contain large concentrations of sulfur compounds.

This land type is along the Choptank River and other major rivers in the county. It is not used for cultivated crops, tree crops, or pasture at the present time. Some areas provide food and cover for wildlife. (Capability unit VIIIw–1; sewage disposal group 8)

Woodstown Series

The Woodstown series consists of deep, sandy, moderately well drained soils that have a mottled subsoil. These soils occur on uplands. They formed in beds of unconsolidated sand, silt, and clay of the Coastal Plain. They are sandy throughout, and the subsoil is sandy clay loam.

Woodstown soils developed in about the same kind of material as the well-drained Sassafras soils, the poorly drained Fallsington soils, and the very poorly drained Pocomoke soils. Woodstown soils are similar to Mattapex soils, but they are less silty and they are sandy throughout. They are less sandy, particularly in the subsoil, than the moderately well drained Klej soils.

Soils of the Woodstown series are fairly extensive in this county and are important in agriculture.

Profile of Woodstown sandy loam, 0 to 2 percent slopes, in a forested area about 3 miles east of Chapel Bridge:

A1—0 to 1 inch, very dark grayish-brown (10YR 3/2) sandy loam; weak, fine, crumb structure; very friable when moist, nonplastic and nonsticky when wet; roots abundant; strongly acid; clear, wavy boundary; horizon is ½ to 2 inches thick.

A2—1 to 8 inches, light olive-brown (2.5Y 3/4) sandy loam; weak, medium, crumb structure; very friable when moist, nonplastic and nonsticky when wet; roots plentiful; strongly acid; clear, smooth boundary; horizon is 6 to 8 inches thick.

B21—8 to 16 inches, olive-yellow (2.5Y 6/6) light sandy clay loam; weak, medium to coarse, subangular blocky structure; friable when moist, slightly plastic and slightly sticky when wet; roots fairly common; very strongly acid; gradual, smooth boundary; horizon is 7 to 10 inches thick.

B22g—16 to 24 inches, light olive-brown (2.5Y 5/6) light sandy clay loam; common, medium, distinct mottles of pale yellow (2.5Y 7/4) and few, prominent, fine mottles of strong brown (7.5YR 5/8); weak, coarse, blocky structure; friable when moist, slightly plastic and slightly sticky when wet; very few roots; a few patchy clay skins and some clay flows of olive yellow (2.5Y 6/6); strongly acid; abrupt, smooth boundary; horizon is 6 to 12 inches thick.

C1g—24 to 29 inches, yellowish-brown (10YR 5/6) heavy loamy sand; few, medium, prominent mottles of pale olive (5Y 6/3); single grain; very friable when moist, nonplastic and nonsticky when wet; no roots; very strongly acid; gradual, smooth to diffuse boundary; horizon is 4 to 8 inches thick.

C2g—29 to 36 inches, dark yellowish-brown (10YR 4/4) loamy sand; structureless; loose; few, coarse, prominent mottles of pale yellow (5Y 7/3) and few, fine, prominent mottles of strong brown (7.5YR 5/8); no roots; very strongly acid; clear, smooth boundary; horizon is 5 to 8 inches thick.

C3—36 to 44 inches, yellow (2.5Y 7/6) loamy sand; structureless; loose; no roots; contains a few rather firm lenses or lumps of yellowish-brown (10YR 5/4) sandy loam or sandy clay loam; very strongly acid; abrupt, smooth boundary; horizon is 6 to 10 inches thick.

D1g—44 to 50 inches, light-gray (5Y 7/1) sandy clay; massive; very firm when moist, very plastic and very sticky when wet; no roots; very strongly acid; abrupt, smooth boundary; horizon is 5 to 7 inches thick.

D2g—50 to 60 inches +, light-gray (5Y 7/1) sand; structureless; loose; very strongly acid.

In cultivated areas the plow layer is grayish brown or dark grayish brown (10YR 5/2 or 4/2). Depth to the B22g horizon ranges from 15 to 30 inches, but in most places it is nearer 15 inches. In some places the substratum is dominantly gray, has little or no mottling, and contains fine cherty gravel.

Woodstown loam, 0 to 2 percent slopes (WdA).—Except for the finer texture of its A horizon, this soil is like Woodstown sandy loam, 0 to 2 percent slopes. Wetness, especially during the planting season and early in the growing season, is the chief limitation. Removing the excess water is the main management problem. If adequately drained this soil can be used regularly for most of the crops commonly grown in the county. (Capability unit IIw–1; drainage group 2A; sewage disposal group 7; irrigation group 4; woodland suitability group 1)

Woodstown loam, 2 to 5 percent slopes, moderately eroded (WdB2).—Erosion has removed part of the original surface layer of this soil. Internal drainage is impeded, but erosion is the main management problem. If adequately drained and protected from further erosion, this soil can be cultivated regularly. It is suited to the crops commonly grown in the county. (Capability unit IIe–16; drainage group 2A; sewage disposal group 7; irrigation group 4; woodland suitability group 1)

Woodstown sandy loam, 0 to 2 percent slopes (WoA).—This is one of the most extensive soils in the county, and it is important in agriculture. The profile is the one described as representative of the series. This soil is easier to drain and to manage than the Woodstown loams, because it contains more sand. Water control is the main management problem, since excess water during the planting season and early in the growing season is a serious limitation. If adequately drained, this soil can be cultivated regularly. It is suited to most crops commonly grown in the county. (Capability unit IIw–5; drainage group 2B; sewage disposal group 7; irrigation group 3; woodland suitability group 2)

Woodstown sandy loam, 2 to 5 percent slopes (WoB).—Erosion has not been active on this soil, but the erosion hazard presents a more serious management problem than impeded drainage. This soil can be cultivated regularly if adequate drainage is provided and if conservation practices to control erosion are used. It is suited to most of the crops commonly grown in the county. (Capability unit IIe–36; drainage group 2B; sewage disposal group 7; irrigation group 3; woodland suitability group 2)

Woodstown sandy loam, 2 to 5 percent slopes, moderately eroded (WoB2).—This soil has lost part of its original surface layer through erosion. Internal drainage is impeded. If adequately drained and protected from further erosion, this soil can be used regularly for most of the crops commonly grown in the county. (Capability unit IIe–36; drainage group 2B; sewage disposal group 7; irrigation group 3; woodland suitability group 2)

Woodstown sandy loam, 5 to 10 percent slopes (WoC).—Because of the slope, this soil is susceptible to erosion. An additional limitation results from impeded internal drainage. This soil can be cultivated regularly if conservation practices to control erosion are included in management. Long rotations that consist mostly of close-growing crops should be used. (Capability unit IIIe–36; sewage disposal group 7; irrigation group 3; woodland suitability group 2)

Use and Management of the Soils

This section discusses the system of land capability classification used by the Soil Conservation Service and gives the classification of the soils of Caroline County according to that system. It describes management practices for groups of soils that have similar potentialities and management requirements, and it gives estimates of average yields of the common crops. It groups the soils according to their suitability for use as woodland and gives information that is useful in the management of woodland; it groups the soils according to their suitability for wildlife habitats and gives facts about the management of wildlife; it interprets the soil characteristics that are significant in road construction; it groups the soils according to their suitability for irrigation, for drainage, and for sewage disposal; and it discusses soils in relation to community planning.

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable they are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range

of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops or of wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the country, indicates that the chief limitation is a climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it have little or no erosion hazard but have other limitations that limit their use largely to pasture, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. The capability units are convenient groupings for making many statements about management of soils. Capability units are generally identified by numbers assigned locally for example, IIe–4 or IIIe–5.

Soils are classified in capability classes, subclasses, and units, in accordance with the degree and kind of their permanent limitations, but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil, and without consideration of possible but unlikely major reclamation projects. Caroline County has approximately 35,128 acres of class I soils; 76,438 acres of class II soils; 76,907 acres of class III soils; 5,748 acres of class IV soils; 4,375 acres of class VI soils; 3,299 acres of class VII soils; and 2,874 acres of class VIII soils. There are no class V soils in the county.

The soils of Caroline County have been grouped into the following classes, subclasses, and capability units. The numbers of the capability units in the following list are not consecutive because a statewide system for numbering capability units is used, and only some of these capability units are represented in this county.

Class I.—Soils that have few limitations that restrict their use.
- Unit I–4.—Deep, well-drained, medium-textured, nearly level soils on uplands.
- Unit I–5.—Deep, well-drained, moderately coarse textured, nearly level soils on uplands.

Class II.—Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
- Subclass IIe.—Nearly level or gently sloping soils that are moderately limited by risk of erosion if tilled and not protected.
  - Unit IIe–4.—Deep, well-drained, medium-textured, gently sloping soils on uplands.
  - Unit IIe–5.—Deep, well-drained, moderately coarse textured, gently sloping soils on uplands.
  - Unit IIe–16.—Moderately well drained, medium-textured, gently sloping soils.
  - Unit IIe–36.—Moderately well drained, moderately coarse textured, gently sloping soils.
- Subclass IIw.—Soils moderately limited by excess water.
  - Unit IIw–1.—Nearly level, medium-textured soils that have impeded drainage.
  - Unit IIw–5.—Nearly level, moderately coarse textured soils that have impeded drainage.
- Subclass IIs.—Soils moderately limited by low available moisture capacity or poor tilth.
  - Unit IIs–4.—Deep, nearly level to gently sloping, well-drained to somewhat excessively drained soils that have a coarse-textured surface layer and a finer textured subsoil.

Class III.—Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
- Subclass IIIe.—Soils severely limited by risk of erosion if they are cultivated and not protected.
  - Unit IIIe–5.—Deep, well-drained, moderately coarse textured, moderately sloping soils.
  - Unit IIIe–33.—Deep, well-drained and somewhat excessively drained, moderately sloping, coarse-textured soils with a finer textured subsoil.
  - Unit IIIe–36.—Moderately well drained, moderately coarse textured, moderately sloping soils.
- Subclass IIIw.—Soils severely limited by excess water.
  - Unit IIIw–6.—Nearly level, poorly drained and very poorly drained, moderately coarse textured soils.
  - Unit IIIw–7.—Nearly level, poorly drained and very poorly drained, medium-textured soils.
  - Unit IIIw–9.—Nearly level, poorly drained and very poorly drained, medium-textured soils that have a fine-textured, very slowly permeable subsoil.
  - Unit IIIw–10.—Nearly level to gently sloping, moderately well drained to somewhat poorly drained, coarse-textured soils that have a sandy subsoil.
- Subclass IIIs.—Soils severely limited by low available moisture capacity or poor tilth.
  - Unit IIIs–1.—Level to gently sloping, somewhat excessively drained and excessively drained, coarse-textured soils that have a very sandy subsoil.

Class IV.—Soils that have very severe limitations that restrict the choice of plants, or require very careful management, or both.
- Subclass IVe.—Soils very severely limited by risk of erosion if they are cultivated and not protected.
  - Unit IVe–5.—Deep, well-drained, strongly sloping, moderately coarse textured and coarse textured soils.

Subclass IVw.—Soils very severely limited by excess water.
Unit IVw–6.—Nearly level, wet, coarse-textured soils.
Subclass IVs.—Soils very severely limited by low available moisture capacity or other soil features.
Unit IVs–1.—Somewhat excessively drained and excessively drained, moderately sloping loamy sands and nearly level to moderately sloping sands.

Class VI.—Soils that have severe limitations that make them generally unsuited for cultivation and limit their use largely to pasture, range, woodland, or wildlife food and cover.
Subclass VIe.—Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.
Unit VIe–2.—Very strongly sloping, moderately well drained and well drained, coarse-textured to medium-textured soils.
Subclass VIw.—Soils severely limited by excess water and generally unsuited to cultivation.
Unit VIw–1.—Nearly level, wet, mixed soils that are subject to flooding.
Subclass VIs.—Soils generally unsuited to cultivation and limited for other uses because of droughtiness.
Unit VIs–1.—Strongly sloping, excessively drained, very coarse textured soils with a very sandy subsoil.

Class VII.—Soils that have very severe limitations that make them unsuited to cultivation without major reclamation, and that restrict their use largely to grazing, woodland, or wildlife.
Subclass VIIe.—Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.
Unit VIIe–2.—Deep, well-drained, steep and very steep, moderately coarse textured soils.
Subclass VIIw.—Soils very severely limited by excess water.
Unit VIIw–1.—Very wet, unclassified soil material.
Subclass VIIs.—Soils very severely limited by extreme hazards of droughtiness.
Unit VIIs–1.—Strongly sloping to very steep, somewhat excessively drained and excessively drained, very coarse textured soils.

Class VIII.—Soils and land types that have limitations that preclude their use for commercial plant production, and restrict their use to recreation, wildlife, water supply, or esthetic purposes.
Subclass VIIIw.—Soils too wet and too salty for agricultural use.
Unit VIIIw–1.—Areas that are flooded regularly by high tides.

Management by Capability Units

In table 5 each capability unit in Caroline County is described briefly, the soils in each are listed, and some suggestions for the use and management of these soils are given.

General Management Requirements

Some management practices are applicable to all the soils of Caroline County. These include draining the soils that are wet all or part of the year, applying the proper soil amendments, choosing a suitable rotation, and tilling the soils properly. These basic management practices are discussed in this section. Management for irrigated crops, such as vegetables and fruits, is discussed under the heading "Irrigation Groups."

Drainage

Improving drainage is one of the main management needs in Caroline County. About 91,000 acres needs some degree of artificial drainage. Few farms in the county are located entirely on well-drained soils. Yields are often poor or crops fail completely unless drainage is well established, maintained, and controlled.

Moderately well drained soils make up about 27 percent of the cultivated acreage that needs drainage. Such soils need drainage only to remove excess water during wet periods. Poorly drained and very poorly drained soils make up about 73 percent of the acreage of soils needing drainage. These soils need intensive improvement in drainage if most crops are to be grown successfully.

More complete information about drainage needed for the soils in this county can be found under the heading "Drainage Groups."

The general drainage requirements of the soils used for cultivated crops are as follows:

1. Soils requiring no artificial drainage: Galestown, Lakeland, Matapeake, and Sassafras.
2. Soils requiring moderate artificial drainage: Klej, Mattapex, and Woodstown.
3. Soils requiring intensive artificial drainage: Bibb, Elkton, Fallsington, Othello, and Plummer.
4. Soils requiring very intensive artificial drainage: Bayboro, Johnston, Pocomoke, and Portsmouth.
5. Soils requiring special drainage practices: Muck.

Soil amendments

Fertilizer and lime are needed for most crops grown in Caroline County. Assistance in determining the specific requirements of each soil can be obtained from the county agricultural agent or the local representatives of the Soil Conservation Service. Either can arrange to have soils tested at the Soil Testing Laboratory of the University of Maryland.

Lime needs to be applied about once every 3 years. Very sandy soils and well drained and moderately well drained soils need applications of about 1 to 1½ tons per acre of ground limestone or its equivalent. Most of the other soils need 2 to 3 tons per acre, but wet soils that are high in organic matter, for example, those of the Bayboro, Pocomoke, and Portsmouth series, require much more. Different soils in the same field may require different amounts of lime. For example, for well-drained sandy soils, 1 ton of lime per acre may be required, but wet soils and dark-colored soils may need 5 tons per acre. Using too much lime, particularly on a sandy soil, should be avoided just as carefully as using too little.

TABLE 5.—*Use and management of soils, by capability units*

General description of capability unit and names of soils	Suitable uses and management requirements
Unit I–4 (5,175 acres): Deep, well-drained, medium-textured, nearly level soils on uplands. Matapeake silt loam, 0 to 2 percent slopes. Sassafras loam, 0 to 2 percent slopes. Sassafras loam, heavy substratum, 0 to 2 percent slopes.	The soils of this unit are the best for agriculture of any in the county. They retain moisture and plant nutrients well, are fairly easy to work, are highly productive, and are suited to many different uses. Corn, soybeans, and small grain are grown extensively. Hay crops and pasture crops are grown to a lesser extent. These soils are excellent for orchards and strawberries. For high yields, fertility must be maintained, lime must be applied as needed, and legumes and green-manure crops must be grown. These soils do not need artificial drainage, nor do they need special practices to help control erosion.
Unit I–5 (29,953 acres): Deep, well-drained, moderately coarse textured, nearly level soils on uplands. Sassafras sandy loam, 0 to 2 percent slopes. Sassafras sandy loam, heavy substratum, 0 to 2 percent slopes.	The soils of this unit are somewhat more sandy than the soils of unit I–4, but they are well suited to most of the same crops. They are better suited to truck crops and strawberries and are easier to work. With fertility maintenance and supplemental irrigation as required, yields of most crops are high in normal years. Under good management these soils can be cultivated intensively over a long period of time. They do not need artificial drainage or special practices to control erosion.
Unit IIe–4 (1,178 acres): Deep, well-drained, medium-textured, gently sloping soils on uplands. Matapeake silt loam, 2 to 5 percent slopes, moderately eroded. Sassafras loam, 2 to 5 percent slopes, moderately eroded.	The soils of this unit require contour tillage and longer rotations for control of erosion, but otherwise they can be used and managed in about the same way as the soils of unit I–4. Rotations should include hay or other close-growing crops. Some small areas are too hummocky for contour farming.
Unit IIe–5 (32,964 acres): Deep, well-drained, moderately coarse textured, gently sloping soils on uplands. Sassafras sandy loam, 2 to 5 percent slopes. Sassafras sandy loam, 2 to 5 percent slopes, moderately eroded. Sassafras sandy loam, heavy substratum, 2 to 5 percent slopes.	The soils of this unit have about the same uses as those of unit I–5, but they require contour tillage, longer rotations, and more close-growing crops for control of erosion. In some areas the slopes are too irregular for contour farming.
Unit IIe–16 (298 acres): Moderately well drained, medium-textured, gently sloping soils. Mattapex silt loam, 2 to 5 percent slopes, moderately eroded. Woodstown loam, 2 to 5 percent slopes, moderately eroded.	The soils of this unit need improvement of drainage and protection against erosion. Tile drains are needed, and also diversions and some means of disposing of excess water. These soils are suited to most commonly grown crops, but they are slow to warm up in the spring and are unsuitable for early planting. Alfalfa and similar crops are damaged by winter heaving.
Unit IIe–36 (2,227 acres): Moderately well drained, moderately coarse textured, gently sloping soils. Woodstown sandy loam, 2 to 5 percent slopes. Woodstown sandy loam, 2 to 5 percent slopes, moderately eroded.	The soils of this unit are similar to those of unit IIe–16, except that they are sandier throughout and are more easily drained and worked. They are suited to truck crops and to strawberries. Although tile drains and diversions are needed, they need not be so closely spaced. These soils are suitable for fairly early spring planting.
Unit IIw–1 (3,522 acres): Nearly level, medium-textured soils that have impeded drainage. Mattapex silt loam, 0 to 2 percent slopes. Woodstown loam, 0 to 2 percent slopes.	The soils of this unit are suited to most crops, in spite of their impeded drainage. They are not suited to alfalfa, which tends to winter heave. In dry years, these soils are more productive than some of the better drained soils, because they store more moisture. Ditches should not be deep enough to extend into the sandy substratum, because the sandy material tends to flow and cave into channels. Some means of disposing of the excess water is needed. These soils need fertilizer and lime.
Unit IIw–5 (17,025 acres): Nearly level, moderately coarse textured soils that have impeded drainage. Woodstown sandy loam, 0 to 2 percent slopes.	This soil is used and managed in about the same way as the soils of unit IIw–1, but it is sandier throughout and is more easily worked. Unless well fertilized, it is somewhat less productive. Drainage is the main management problem. If adequately drained, this soil warms up more quickly in the spring than most other soils that have impeded drainage. Ditches used to carry off excess water should not extend into the sandy substratum, which is likely to cave.
Unit IIs–4 (19,224 acres): Deep, nearly level to gently sloping, well-drained to somewhat excessively drained soils that have a coarse-textured surface layer and a finer textured subsoil. Sassafras loamy sand, 0 to 2 percent slopes. Sassafras loamy sand, 2 to 5 percent slopes. Sassafras loamy sand, 2 to 5 percent slopes, moderately eroded.	The soils of this unit have a thick surface layer of loamy sand and a friable sandy clay loam subsoil that is underlain by sand below a depth of 24 to 30 inches. These soils are low in plant nutrients and organic matter. The available moisture capacity is low. Supplying moisture is the main problem. Supplemental irrigation is desirable in all areas and is necessary in some areas. Most crops, and especially truck crops, are well suited. If adequate moisture is supplied and enough fertilizer is used, fair to high yields are obtained.

TABLE 5.—*Use and management of soils, by capability units*—Continued

General description of capability unit and names of soils	Suitable uses and management requirements
Unit IIIe-5 (792 acres): Deep, well-drained, moderately coarse textured, moderately sloping soils. Sassafras sandy loam, 2 to 5 percent slopes, severely eroded. Sassafras sandy loam, 5 to 10 percent slopes. Sassafras sandy loam, 5 to 10 percent slopes, moderately eroded.	The soils of this unit are similar to the soils of units I–5 and IIe–5, but they have stronger slopes and are more susceptible to erosion. Management should include contour tillage, buffer strips, careful disposal of excess water through sodded drainageways, and rotations that are mostly hay crops or other close-growing crops.
Unit IIIe–33 (808 acres): Deep, well-drained and somewhat excessively drained, moderately sloping, coarse-textured soils with a finer textured subsoil. Sassafras loamy sand, 5 to 10 percent slopes. Sassafras loamy sand, 5 to 10 percent slopes, moderately eroded.	The soils of this unit are similar to those of unit IIs–4, except that they have stronger slopes. Protection from erosion is the main management requirement. For high yields, however, it is necessary to maintain fertility and a good supply of moisture; supplemental irrigation is desirable in all areas, and it is necessary in some areas. Contour tillage and stripcropping will help to control runoff and prevent further erosion. The rotation should be longer on these soils than on less sloping soils.
Unit IIIe–36 (71 acres): Moderately well-drained, moderately coarse textured, moderately sloping soils. Woodstown sandy loam, 5 to 10 percent slopes.	The one soil of this unit has the same characteristics as the soils of units IIw–5 and IIe–36, but it has stronger slopes and is more susceptible to erosion. Erosion control and drainage, particularly the disposal of surface water, are the main management requirements. This soil responds to good management. Yields of most crops are good. Alfalfa is not suited.
Unit IIIw–6 (34,367 acres): Nearly level, poorly drained and very poorly drained, moderately coarse textured soils. Fallsington sandy loam. Pocomoke sandy loam.	The soils of this unit are of limited use for crops unless artificially drained. These soils are well suited to tiling, but deep open ditches are difficult to maintain because the sand tends to cave and flow. Tile must be properly spaced, carefully installed, and well maintained. Yields are good if drainage is established and lime and fertilizer are applied. These soils are not well suited to lespedeza and alfalfa. They are not used extensively to grow small grain.
Unit IIIw–7 (24,190 acres): Nearly level, poorly drained and very poorly drained, medium-textured soils. Bibb silt loam. Fallsington loam. Johnston loam. Othello silt loam. Pocomoke loam. Portsmouth silt loam.	The soils of this unit are similar to those of unit IIIw–6, except that they are finer textured and more slowly permeable. Bibb and Johnston soils are subject to flooding. The soils of this unit are difficult to drain. Tile must be more closely spaced than in the soils of unit IIIw–6. Ditches are effective if they do not penetrate the sandy substratum. Fertilizer is needed, and tests should be made frequently to determine the need for lime.
Unit IIIw–9 (2,465 acres): Nearly level, poorly drained and very poorly drained, medium-textured soils that have a fine-textured, very slowly permeable subsoil. Bayboro silt loam. Elkton loam. Elkton silt loam.	The soils of this unit are difficult to drain because the subsoil is fine textured and slowly permeable. Excess water can be removed by means of field ditches. Because these soils are hard when dry and very sticky when wet, they can be cultivated only within a narrow range of moisture content. If these soils are adequately drained, fertilized, and limed, corn and soybeans can be grown. They are not suited to small grain and hay crops, but they could be used more extensively for pasture.
Unit IIIw-10 (1,553 acres): Nearly level to gently sloping, moderately well-drained to somewhat poorly drained, coarse-textured soils that have a sandy subsoil. Klej loamy sand, 0 to 2 percent slopes. Klej loamy sand, 2 to 5 percent slopes.	The soils of this unit are very permeable, strongly acid, and low in plant nutrients. They are wet in wet seasons, but they store little moisture that can be supplied to plants during dry seasons. Surface drainage is needed if cultivated crops are to be grown. Because the sand tends to flow, a drainage system is difficult to maintain. Fertilization and supplemental irrigation are needed for good yields. Under good management most crops commonly grown in the area can be grown. Yields are somewhat lower than on the better agricultural soils.
Unit IIIs–1 (12,661 acres): Level to gently sloping, somewhat excessively drained and excessively drained, coarse-textured soils that have a very sandy subsoil. Galestown loamy sand, 0 to 2 percent slopes. Galestown loamy sand, 2 to 5 percent slopes. Lakeland loamy sand, clayey substratum, 0 to 2 percent slopes. Lakeland loamy sand, clayey substratum, 2 to 5 percent slopes.	The soils of this unit are acid, rapidly permeable, low in plant nutrients, low in organic-matter content, and low in moisture-holding capacity. They are susceptible to wind erosion when bare of vegetation. Means of controlling erosion include growing a close-growing crop in the rotation, planting crops in strips crosswise to the direction of the strongest winds, establishing windbreaks, and keeping crop residues on the surface or plowing them into the surface layer. These soils require some lime and large amounts of fertilizer. They are suited to sweetpotatoes and other vegetables. Because they tend to be droughty, supplemental irrigation is likely to be needed.

TABLE 5.—*Use and management of soils, by capability units*—Continued

General description of capability unit and names of soils	Suitable uses and management requirements
Unit IVe–5 (1,151 acres): Deep, well-drained, strongly sloping, moderately coarse textured and coarse textured soils. Sassafras loamy sand, 5 to 10 percent slopes, severely eroded. Sassafras loamy sand, 10 to 15 percent slopes. Sassafras sandy loam, 5 to 10 percent slopes, severely eroded. Sassafras sandy loam, 10 to 15 percent slopes. Sassafras sandy loam, 10 to 15 percent slopes, moderately eroded.	The soils of this unit are similar to those of units I–5, IIe–5, and IIIe–5, but they have stronger slopes and are more susceptible to erosion. Means of controlling erosion include contour striperopping, contour tillage, establishing buffer strips, rough cultivation, and, in some places, terracing. Runoff should be diverted through well-maintained waterways and outlets. Under good management, good yields can be obtained. Growing soybeans tends to encourage erosion.
Unit IVw–6 (492 acres): Nearly level, wet, coarse-textured soils. Plummer loamy sand.	This soil is of limited use for crops because of poor drainage. It can be drained by tile or by field ditches, but ditches are difficult to maintain. If adequately drained this soil is best suited to high-value crops, such as truck crops and blueberries. Large amounts of fertilizer and some lime are needed to obtain average yields.
Unit IVs–1 (4,105 acres): Somewhat excessively drained and excessively drained, moderately sloping loamy sands and nearly level to moderately sloping sands. Galestown loamy sand, 5 to 10 percent slopes. Galestown sand, 0 to 2 percent slopes. Galestown sand, 2 to 5 percent slopes. Lakeland loamy sand, clayey substratum, 5 to 10 percent slopes. Lakeland sand, clayey substratum, 2 to 10 percent slopes.	The soils of this unit are similar to those of unit IIIs–1, but some are coarser textured and some have strong enough slopes to be susceptible to water erosion as well as to wind erosion. These soils require more fertilizer than those of unit IIIs–1, and also better moisture conservation practices. Contour terracing, contour tillage, and other erosion control practices are needed on the stronger slopes. Because the soils tend to be droughty, supplemental irrigation may be needed.
Unit VIe–2 (1,390 acres): Very strongly sloping, moderately well drained and well drained, coarse-textured to medium-textured soils. Matapeake silt loam, 15 to 30 percent slopes. Mattapex silt loam, 15 to 30 percent slopes. Sassafras loamy sand, 15 to 30 percent slopes. Sassafras sandy loam, 15 to 30 percent slopes.	The soils of this unit are too steep for cultivated crops, but they can be used to a limited extent for hay, pasture, or woodland. The most intensive use to which they are suited is improved pasture. Pastures need to be prepared for seeding. Planting can be done by seeding or sprigging. The areas will require fertilizer, and lime should be applied as needed. Pastures should not be overgrazed, because of the severe erosion hazard. Sassafras loamy sand is more droughty than Sassafras sandy loam.
Unit VIw–1 (2,595 acres): Nearly level, wet, mixed soils that are subject to flooding. Mixed alluvial land.	This unit consists of mixed soil material on flood plains. These areas are poorly drained or very poorly drained and are subject to flooding. They are not suited to cultivated crops, but if drained and protected from flooding they will produce hay and pasture crops. They can also be used for woodland and to provide food and cover for wildlife.
Unit VIs–1 (390 acres): Strongly sloping, excessively drained, very coarse textured soils with a very sandy subsoil. Galestown loamy sand, 10 to 15 percent slopes. Galestown sand, 5 to 10 percent slopes.	The soils of this unit are too steep, too sandy, and too droughty to be used for cultivated crops, but they are suitable for deep-rooted forage plants. Even under good management, yields are not high. Grazing should be carefully controlled, because bare areas will erode. Loblolly pine can be planted, and good stands of other pines should be preserved.
Unit VIIe–2 (162 acres): Deep, well-drained, steep and very steep, moderately coarse textured soil. Sassafras sandy loam, 30 to 60 percent slopes.	This soil is too steep to be cultivated or used for hay crops. It is suited to very limited grazing. The best use for this soil is forest. It is well suited to Virginia pine, loblolly pine, and some hardwoods.
Unit VIIw–1 (2,074 acres): Very wet, unclassified soil material. Muck. Swamp.	The land types in this unit are not used for cultivated crops, because drainage is impractical. They are suitable only for wetland forests, which provide shelter for wildlife. Some areas can be used for limited grazing when the water is low.
Unit VIIs–1 (1,063 acres): Strongly sloping to very steep, somewhat excessively drained and excessively drained, very coarse textured soils. Galestown loamy sand, 15 to 30 percent slopes. Galestown loamy sand, 30 to 60 percent slopes. Galestown sand, 10 to 15 percent slopes. Galestown sand, 15 to 30 percent slopes.	The soils of this unit are severely limited by droughtiness. They are coarse textured, excessively drained, and rapidly permeable. They are not suited to cultivated crops or to pasture but may provide shelter and limited grazing for livestock. They also provide food and shelter for wildlife. Virginia pine and loblolly pine can be grown for pulpwood.
Unit VIIIw–1 (2,775 acres): Areas that are flooded regularly by high tides. Tidal marsh.	This unit consists entirely of areas that are flooded regularly by high tides. The soil material is too wet and salty to be used for agriculture. The areas make good wildlife habitats, particularly for muskrats and waterfowl.

Soils that are cultivated year after year become deficient in nitrogen, phosphorus, and potassium unless these elements are replenished regularly. Unlike phosphorus and potassium, nitrogen does not come from the mineral part of the soil itself. Nitrogen compounds are produced by some plants, especially by soybeans and other legumes, but more commonly nitrogen is supplied in fertilizer. Nitrogen fertilizer is needed for all crops except legumes, and sometimes legumes benefit from additional nitrogen. Part of the nitrogen in plants is returned to the soil in plant residues that decompose to form organic matter. The organic matter not only returns some nitrogen and other plant nutrients to the soil, but it also improves the water-holding capacity and the tilth. This, in turn, helps to reduce susceptibility to erosion.

Manure is an important source of nitrogen and organic matter, and it supplies smaller amounts of other plant nutrients. The amount of manure and the kind and amount of fertilizer depend on the kind of crop to be grown. Small grains need a complete fertilizer in addition to a topdressing of nitrogen. Generally, nitrogen for corn is supplied as a sidedressing. Legumes need phosphorus and potassium, applied both at seeding and later as a topdressing.

Rotations

A good crop rotation is an efficient means of maintaining the supply of organic matter in the soil. One good system consists of growing a legume or green-manure crop before a corn crop. When the legume or green-manure crop is plowed under, it adds organic matter and nitrogen to the soil. As a result, the corn crop that follows generally produces a higher yield and is better able to withstand dry weather.

A 3-year rotation should include corn or soybeans for 1 year, then a small grain, followed by a hay crop consisting of or including a legume. Such a rotation helps to control erosion. It is well suited to the soils of capability subclass IIe.

For soils in capability subclass IIIe, a rotation lasting at least 4 years is needed. The rotation should include 2 years of hay or other close-growing crops. Soils of subclass IVe need at least a 5-year rotation, if possible, or a 4-year rotation in which the small grain is omitted. The rotation should include 1 year of corn and 3 years of hay or a cover crop. Soybeans tend to make the soil more susceptible to erosion, and should not be planted on the soils of subclass IVe.

A good rotation helps to control insects and soil-borne diseases. It slows down the rate at which some plant nutrients are depleted. If large amounts of insecticides or fungicides have been applied to vegetable crops, growing a different kind of crop for at least 1 or 2 years will help rid the soils of the residual effects of the chemicals.

Tillage

Soils must be kept in good condition if they are to produce maximum yields of crops. Tillage of any kind breaks down the structure of the soils, causes loss of organic matter, and increases the hazard of erosion. Breakdown of the soil structure is gradual and is not easily noticed until the damage has become serious.

The continued use of the heavy machinery commonly used to cultivate corn and soybeans causes many of the poorly drained, finer textured soils, such as Elkton and Othello silt loams, to become compacted and hard to work. The result is more serious if the soils are too wet when the machinery is used. Compaction decreases the rate at which water infiltrates, decreases aeration, and slows down internal drainage. It also increases the rate and amount of runoff of surface water. Replacing organic matter and growing a sod crop will help to restore good structure in such soils.

On all the soils in this county, tillage should be kept to a minimum. The poorly drained, finer textured soils can be cultivated only within a narrow range of moisture content. Puddling and compaction will result if they are cultivated when too wet or too dry. Very sandy, well-drained soils can be cultivated safely over a much wider range of moisture content. The amount of cultivation necessary to produce a crop can be reduced by the use of herbicides.

All sloping soils that are susceptible to erosion but that are suitable for cultivation (capability subclasses IIe, IIIe, and IVe) need to be tilled on the contour. Contour stripcropping (growing alternate strips of clean-cultivated crops with strips of close-growing untilled crops) is needed on the soils of subclasses IIe, IIIe, and IVe. A good rotation can be maintained by staggering the crops on each strip. The stronger the slope, the narrower the strips should be. Information on planning and laying out crop strips can be obtained at the local office of the Soil Conservation Service.

Estimated Yields

Estimated yields of the principal crops on most soils in Caroline County, under two levels of management, are shown in table 6. Estimates of average yields obtained under management practices commonly used in the county are listed in columns A, and estimates obtained under improved management are listed in columns B. Estimated yields for lespedeza are given only under columns B because lespedeza is commonly grown only under very good management.

Management practices assumed for estimating the yields listed in the B columns are as follows: choosing carefully the kind of crop to be grown and the cropping system to be used; preparing the seedbed adequately; planting certified seed by suitable methods, at suitable rates, and at appropriate times; controlling weeds, diseases, and insects; returning plant residues to the soil; applying fertilizer, lime, and manure as indicated by soil tests; controlling water by drainage and by irrigation. Controlling water is a major factor in managing the soils of this county. About 45 percent of the soils suitable for cultivated crops needs some type of drainage and, because they are droughty, about 17 percent of these soils need supplemental irrigation.

TABLE 6.—*Estimated average acre yields of principal crops under two levels of management*

[Yields in columns A are those obtained under management common in the county; those in columns B, under improved management. Absence of figure indicates crop is not suited to the soil specified or is not commonly grown on it]

Soil		Corn		Soybeans		Wheat		Lespedeza	Pasture	
		A	B	A	B	A	B	B	A	B
		Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Tons	Cow-acre-days [1]	Cow-acre-days [1]
Ba	Bayboro silt loam	45	80						85	185
Bm	Bibb silt loam	45	80	25	30	25	35	1.0	60	130
Ek	Elkton loam	40	75	25	30			1.0	85	185
Em	Elkton silt loam	40	75	25	30			1.0	85	185
Fa	Fallsington loam	45	80	25	30	25	40	1.3	60	130
Fs	Fallsington sandy loam	45	80	25	30	25	40	1.3	60	130
GaA	Galestown loamy sand, 0 to 2 percent slopes	25	50	15	20			.6	40	
GaB	Galestown loamy sand, 2 to 5 percent slopes	25	50	15	20			.6	40	
GaC	Galestown loamy sand, 5 to 10 percent slopes	25	50	15	20			.6	40	
GaD	Galestown loamy sand, 10 to 15 percent slopes							.6	40	
GsA	Galestown sand, 0 to 2 percent slopes	20	50	15	20			.5	30	
GsB	Galestown sand, 2 to 5 percent slopes	20	50	15	20			.5	30	
GsC	Galestown sand, 5 to 10 percent slopes	20	50	15	20			.5	30	
GsD	Galestown sand, 10 to 15 percent slopes							.5	30	
Jo	Johnston loam	40	80		25			.9		130
KsA	Klej loamy sand, 0 to 2 percent slopes	35	65	20	25			.9	50	120
KsB	Klej loamy sand, 2 to 5 percent slopes	35	65	20	25			.9	50	120
LaA	Lakeland loamy sand, clayey substratum, 0 to 2 percent slopes	25	50	15	20			.6	40	
LaB	Lakeland loamy sand, clayey substratum, 2 to 5 percent slopes	25	50	15	20			.6	40	
LaC	Lakeland loamy sand, clayey substratum, 5 to 10 percent slopes	25	50	15	20			.6	40	
LcC	Lakeland sand, clayey substratum, 2 to 10 percent slopes	20	50	15	20			.5	30	
MkA	Matapeake silt loam, 0 to 2 percent slopes	65	100	30	40	30	45	2.0	95	210
MkB2	Matapeake silt loam, 2 to 5 percent slopes, moderately eroded	60	100	25	40	25	40	2.0	90	200
MkE	Matapeake silt loam, 15 to 30 percent slopes							1.7	80	170
MsA	Mattapex silt loam, 0 to 2 percent slopes	50	90	25	35	25	40	1.8	95	210
MsB2	Mattapex silt loam, 2 to 5 percent slopes, moderately eroded	45	85	20	30	20	35	1.8	90	200
MsE	Mattapex silt loam, 15 to 30 percent slopes							1.7	80	170
Oh	Othello silt loam	45	80	25	30	25	35	1.4	90	190
Pm	Plummer loamy sand	30	55	15	20				40	110
Po	Pocomoke loam	45	80	25	30	25	35		70	150
Ps	Pocomoke sandy loam	45	80	25	30	25	35		70	150
Pt	Portsmouth silt loam	50	90	25	30	25	35		75	160
SnA	Sassafras sandy loam, 0 to 2 percent slopes	65	100	30	40	30	45	2.0	90	200
SnB	Sassafras sandy loam, 2 to 5 percent slopes	65	100	30	40	30	45	2.0	90	200
SnB2	Sassafras sandy loam, 2 to 5 percent slopes, moderately eroded	60	100	25	40	25	40	2.0	85	190
SnB3	Sassafras sandy loam, 2 to 5 percent slopes, severely eroded	50	90	20	35	20	35	1.7	80	180
SnC	Sassafras sandy loam, 5 to 10 percent slopes	60	100	30	40	30	45	2.0	90	200
SnC2	Sassafras sandy loam, 5 to 10 percent slopes, moderately eroded	60	100	25	40	25	40	2.0	85	190
SnC3	Sassafras sandy loam, 5 to 10 percent slopes, severely eroded	50	90	20	35	20	35	1.7	80	180
SnD	Sassafras sandy loam, 10 to 15 percent slopes	60	100	25	40	25	40	2.0	85	190
SnD2	Sassafras sandy loam, 10 to 15 percent slopes, moderately eroded	60	100	20	35	20	35	1.7	80	180
SnE	Sassafras sandy loam, 15 to 30 percent slopes							1.6	70	150
SsA	Sassafras sandy loam, heavy substratum, 0 to 2 percent slopes	65	100	30	40	30	45	2.0	95	210
SsB	Sassafras sandy loam, heavy substratum, 2 to 5 percent slopes	65	100	30	40	30	45	2.0	95	210
SaA	Sassafras loam, 0 to 2 percent slopes	65	100	30	40	30	45	2.0	90	200
SaB2	Sassafras loam, 2 to 5 percent slopes, moderately eroded	60	100	25	35	25	40	2.0	85	190
SnA	Sassafras loam, heavy substratum, 0 to 2 percent slopes	65	100	30	40	30	45	2.0	90	200
SmA	Sassafras loamy sand, 0 to 2 percent slopes	40	75	20	25	20	30	1.0	75	170

See footnote at end of table.

TABLE 6.—*Estimated average acre yields of principal crops under two levels of management*—Continued

[Yields in columns A are those obtained under management common in the county; those in columns B, under improved management. Absence of figure indicates crop is not suited to the soil specified or is not commonly grown on it]

Soil		Corn		Soybeans		Wheat		Lespedeza	Pasture	
		A	B	A	B	A	B	B	A	B
		Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Tons	Cow-acre-days [1]	Cow-acre-days [1]
SmB	Sassafras loamy sand, 2 to 5 percent slopes	40	75	20	25	20	30	1.0	75	170
SmB2	Sassafras loamy sand, 2 to 5 percent slopes, moderately eroded	35	70	20	25	20	30	1.0	65	160
SmC	Sassafras loamy sand, 5 to 10 percent slopes	35	70	20	25	20	30	1.0	70	165
SmC2	Sassafras loamy sand, 5 to 10 percent slopes, moderately eroded	35	70	20	25	20	30	1.0	65	160
SmC3	Sassafras loamy sand, 5 to 10 percent slopes, severely eroded	25	60	15	25	15	25	.8	50	150
SmD	Sassafras loamy sand, 10 to 15 percent slopes	30	65	15	25	15	30	1.0	60	160
SmE	Sassafras loamy sand, 15 to 30 percent slopes							.7	40	100
WdA	Woodstown loam, 0 to 2 percent slopes	45	85	20	30	20	35	1.8	90	200
WdB2	Woodstown loam, 2 to 5 percent slopes, moderately eroded	40	85	20	30	20	30	1.8	85	200
WoA	Woodstown sandy loam, 0 to 2 percent slopes	40	85	20	30	20	35	1.8	85	200
WoB	Woodstown sandy loam, 2 to 5 percent slopes	40	85	20	30	20	35	1.8	85	200
WoB2	Woodstown sandy loam, 2 to 5 percent slopes, moderately eroded	35	75	20	30	20	30	1.8	75	190
WoC	Woodstown sandy loam, 5 to 10 percent slopes	35	75	20	30	20	30	1.8	75	190

[1] The number of days a year 1 acre will graze a cow, a horse, or a steer without injury to the pasture.

Woodland [2]

About 7,790 acres, or 35 percent of the county, consisted of woodland at the time this soil survey was made. Practically no virgin forests remain in Caroline County.

Woodland suitability groups

Just as soils are placed in capability units according to their suitability for crops and pasture, they can also be grouped according to their suitability for trees. Each woodland suitability group is made up of soils that are suitable for the same kinds of trees, that require similar management and conservation practices, and that are about the same in potential productivity.

The potential productivity of a soil for trees is expressed as the site index, which is the height, in feet, that trees of a given kind, growing on that soil, will attain in 50 years. For the soils of Caroline County, site indexes have been determined only for loblolly pine, which is the most important species grown commercially in the area. The site indexes given in this report are based partly on studies made in Caroline County and partly on studies in other counties on the Eastern Shore, in Southern Maryland, and in Delaware.

All the soils in one woodland suitability group have approximately the same site index and are similar with respect to the major limitations and hazards that have to be considered in planning woodland management: species priority, plant competition, equipment limitation, seedling mortality, and windthrow hazard.

Table 7 shows the woodland suitability groups in Caroline County; it gives the average site index for loblolly pine and the range in site index for the soils of the group; it lists species suitable for planting, in order of relative suitability; and it rates as slight, moderate, or severe the principal other factors that affect management.

The descriptions of each of the six woodland suitability groups explain variations from the ratings given in table 7 and give some additional information about management requirements.

Not included in any woodland suitability group are the miscellaneous land types that are not suited to trees or are too wet to be managed economically as woodland. These land types are Made land, Muck, Swamp, and Tidal marsh. These land types have not been rated for loblolly pine or other species of trees.

WOODLAND SUITABILITY GROUP 1

This group consists of deep, moderately well drained and well drained soils that have a surface layer of loam or

[2] This section was prepared with the assistance of CRAIG D. WHITESELL, former research forester, Maryland Department of Research and Education; A. R. BOND, assistant State forester, Maryland Department of Forests and Parks; SILAS LITTLE, JR., forester, Northeastern Forest Experiment Station, U.S. Forest Service; R. L. HALL and WILLIAM U. REYBOLD III, Soil Conservation Service.

silt loam. The subsoil is finer textured than the surface layer and is moderately permeable. The soils are—

- MkA Matapeake silt loam, 0 to 2 percent slopes.
- MkB2 Matapeake silt loam, 2 to 5 percent slopes, moderately eroded.
- MkE Matapeake silt loam, 15 to 30 percent slopes.
- MsA Mattapex silt loam, 0 to 2 percent slopes.
- MsB2 Mattapex silt loam, 2 to 5 percent slopes, moderately eroded.
- MsE Mattapex silt loam, 15 to 30 percent slopes.
- SaA Sassafras loam, 0 to 2 percent slopes.
- SaB2 Sassafras loam, 2 to 5 percent slopes, moderately eroded.
- ShA Sassafras loam, heavy substratum, 0 to 2 percent slopes.
- WdA Woodstown loam, 0 to 2 percent slopes.
- WdB2 Woodstown loam, 2 to 5 percent slopes, moderately eroded.

About 10,294 acres, or 5 percent of the county, is in this group.

These soils are well suited to loblolly pine and to hardwoods. They are well suited to oaks that can be used for timber, to yellow-poplar, and to sweetgum. Wherever these species occur, they should be favored.

Plant competition is severe in areas that have a thick stand of hardwoods. Hardwoods will replace pine readily in areas that have been cleared, if no seed trees are left and if pine is *not* replanted. Ordinarily, special preparation of sites is essential for the regeneration of pine because of the aggressive hardwoods, shrubs, and ground cover. Limitations on the use of equipment are slight, except on the steeper slopes during wet periods. If feasible, logging roads should be constructed on the contour. Practices to control erosion are required on cuts or fills where the soils are sloping.

TABLE 7.—*Woodland suitability groups and ratings for major limitations and hazards affecting management*

Woodland group and map symbols	Site index for loblolly pine [1]	Species priority	Plant competition	Equipment limitations	Seedling mortality	Windthrow hazard
Group 1: Deep, moderately well drained and well drained soils that have a surface layer of loam or silt loam and a moderately permeable subsoil that is finer textured than the surface layer. MkA, MkB2, MkE, MsA, MsB2, MsE, SaA, SaB2, ShA, WdA, WdB2.	83 (77 to 88)	1. Yellow-poplar, oak, sweetgum. 2. Loblolly pine.	Moderate to severe.	Slight	Slight	Slight.
Group 2: Deep, moderately well drained and well drained, somewhat droughty soils that have a surface layer of sandy loam or loamy sand and a moderately permeable to rapidly permeable subsoil. GaA, GaB, GaC, GaD, GaE, GaF, LaA, LaB, LaC, SmA, SmB, SmB2, SmC, SmC2, SmC3, SmD, SmE, SnA, SnB, SnB2, SnB3, SnC, SnC2, SnC3, SnD, SnD2, SnE, SnF, SsA, SsB, WoA, WoB, WoB2, WoC.	83 (78 to 90)	1. Loblolly pine 2. Shortleaf pine. 3. Virginia pine.	Moderate	Slight	Slight	Slight.
Group 3: Very poorly drained to moderately well drained soils that have a surface layer of loamy sand to silt loam and a moderately slowly permeable to rapidly permeable subsoil. Fa, Fs, KsA, KsB, Oh, Pm, Po, Ps, Pt.	86 (80 to 95)	1. Loblolly pine 2. Oak and sweetgum. 3. Yellow-poplar.	Moderate to severe.	Moderate to severe.	Slight	Slight to moderate.
Group 4: Poorly drained and very poorly drained, silty and sandy soils on flood plains; subject to occasional flooding. Bm, Jo, Mt.	85 (80 to 90)	1. Oak and sweetgum 2. Yellow-poplar. 3. Loblolly pine.	Severe	Severe	Slight	Slight.
Group 5: Deep, droughty, sandy soils. GsA, GsB, GsC, GsD, GsE, LcC.	74 (67 to 84)	1. Loblolly pine 2. Shortleaf pine. 3. Virginia pine.	Slight to moderate.	Slight	Moderate	Slight.
Group 6: Poorly drained and very poorly drained, loamy to silty soils that have a fine-textured, slowly permeable subsoil. Ba, Ek, Em.	82 (75 to 89)	1. Loblolly pine 2. Oak and sweetgum.	Severe	Severe	Slight	Moderate.

[1] The figure outside parentheses shows the average site index; the figures in parentheses show the range in site index.

WOODLAND SUITABILITY GROUP 2

This group consists of deep, moderately well drained and well drained, somewhat droughty soils that have a surface layer of sandy loam or loamy sand. The subsoil is moderately permeable to rapidly permeable. The soils are—

GaA Galestown loamy sand, 0 to 2 percent slopes.
GaB Galestown loamy sand, 2 to 5 percent slopes.
GaC Galestown loamy sand, 5 to 10 percent slopes.
GaD Galestown loamy sand, 10 to 15 percent slopes.
GaE Galestown loamy sand, 15 to 30 percent slopes.
GaF Galestown loamy sand, 30 to 60 percent slopes.
LaA Lakeland loamy sand, clayey substratum, 0 to 2 percent slopes.
LaB Lakeland loamy sand, clayey substratum, 2 to 5 percent slopes.
LaC Lakeland loamy sand, clayey substratum, 5 to 10 percent slopes.
SmA Sassafras loamy sand, 0 to 2 percent slopes.
SmB Sassafras loamy sand, 2 to 5 percent slopes.
SmB2 Sassafras loamy sand, 2 to 5 percent slopes, moderately eroded.
SmC Sassafras loamy sand, 5 to 10 percent slopes.
SmC2 Sassafras loamy sand, 5 to 10 percent slopes, moderately eroded.
SmC3 Sassafras loamy sand, 5 to 10 percent slopes, severely eroded.
SmD Sassafras loamy sand, 10 to 15 percent slopes.
SmE Sassafras loamy sand, 15 to 30 percent slopes.
SnA Sassafras sandy loam, 0 to 2 percent slopes.
SnB Sassafras sandy loam, 2 to 5 percent slopes.
SnB2 Sassafras sandy loam, 2 to 5 percent slopes, moderately eroded.
SnB3 Sassafras sandy loam, 2 to 5 percent slopes, severely eroded.
SnC Sassafras sandy loam, 5 to 10 percent slopes.
SnC2 Sassafras sandy loam, 5 to 10 percent slopes, moderately eroded.
SnC3 Sassafras sandy loam, 5 to 10 percent slopes, severely eroded.
SnD Sassafras sandy loam, 10 to 15 percent slopes.
SnD2 Sassafras sandy loam, 10 to 15 percent slopes, moderately eroded.
SnE Sassafras sandy loam, 15 to 30 percent slopes.
SnF Sassafras sandy loam, 30 to 60 percent slopes.
SsA Sassafras sandy loam, heavy substratum, 0 to 2 percent slopes.
SsB Sassafras sandy loam, heavy substratum, 2 to 5 percent slopes.
WoA Woodstown sandy loam, 0 to 2 percent slopes.
WoB Woodstown sandy loam, 2 to 5 percent slopes.
WoB2 Woodstown sandy loam, 2 to 5 percent slopes, moderately eroded.
WoC Woodstown sandy loam, 5 to 10 percent slopes.

This is the most extensive woodland suitability group in Caroline County. The soils in it occupy about 119,679 acres, or 58.4 percent of the county.

The soils in this group are not well suited to hardwoods. Loblolly pine is the favored species, although shortleaf pine and Virginia pine also grow well. Shortleaf pine and Virginia pine should be allowed to grow to a usable size and then be harvested.

There is practically no erosion hazard in areas that are protected by vegetation. Newly planted areas are subject to some wind erosion and, on the stronger slopes, to water erosion also.

WOODLAND SUITABILITY GROUP 3

This group consists of very poorly drained to moderately well drained soils that have a surface layer of loamy sand to silt loam. The subsoil has moderately slow to rapid permeability. The soils are—

Fa Fallsington loam.
Fs Fallsington sandy loam.
KsA Klej loamy sand, 0 to 2 percent slopes.
KsB Klej loamy sand, 2 to 5 percent slopes.
Oh Othello silt loam.
Pm Plummer loamy sand.
Po Pocomoke loam.
Ps Pocomoke sandy loam.
Pt Portsmouth silt loam.

This is one of the most extensive of the woodland suitability groups. The soils occupy about 56,966 acres, or 27.8 percent of the county.

Loblolly pine is the favored species for these soils. Sweetgum, yellow-poplar, and valuable oaks that are growing on the areas should be well managed until they can be harvested and then should be replaced by loblolly pine. Yellow-poplar should be encouraged only on the soils that are well drained.

Competition from other plants is severe on the wetter areas and moderate elsewhere. Operating equipment is difficult during wet periods, especially on soils of the Othello, Pocomoke, and Portsmouth series.

WOODLAND SUITABILITY GROUP 4

This group consists of poorly drained and very poorly drained, silty to sandy soils on flood plains. These soils are likely to be flooded once or twice a year, but the water seldom stands on them long enough to become stagnant. The soils are—

Bm Bibb silt loam.
Jo Johnston loam.
Mt Mixed alluvial land.

About 6,231 acres, or 3 percent of the county, is in this woodland suitability group. The site index given in table 7 is an estimate.

The soils of this group are well suited to hardwoods, which in these areas tend to eliminate pine. Sweetgum and commercially valuable species of oak should be favored. Yellow-poplar should be encouraged on hummocks or natural levees, where drainage is a little better.

Erosion is no problem, except for some scouring during floods.

WOODLAND SUITABILITY GROUP 5

This group consists of deep, droughty, sandy soils. The soils are—

GsA Galestown sand, 0 to 2 percent slopes.
GsB Galestown sand, 2 to 5 percent slopes.
GsC Galestown sand, 5 to 10 percent slopes.
GsD Galestown sand, 10 to 15 percent slopes.
GsE Galestown sand, 15 to 30 percent slopes.
LcC Lakeland sand, clayey substratum, 2 to 10 percent slopes.

About 4,186 acres, or 2 percent of the county, is in this woodland suitability group. The site index given in table 7 is an estimate. The highest indexes apply where the soil is underlain at some depth by a moisture-retaining layer.

Loblolly pine should have first priority on these soils. Virginia pine and shortleaf pine that are growing on the areas should be preserved till they are salable. After they are harvested the areas can be planted to loblolly pine. Loblolly pine and shortleaf pine are cleaner boled trees than Virginia pine.

Plant competition is less severe on the soils of this group than on those of the other groups. The erosion hazard is slight. Seedling mortality is a moderate hazard because of drought in some seasons.

WOODLAND SUITABILITY GROUP 6

This group consists of poorly drained and very poorly drained, loamy and silty soils that have a slowly permeable, fine-textured subsoil. The soils are—

Ba Bayboro silt loam.
Ek Elkton loam.
Em Elkton silt loam.

Elkton soils are gray throughout, but the surface layer of the Bayboro soil is almost black and is fairly high in organic-matter content. About 2,465 acres, or 1.2 percent of the county, is in this group.

Loblolly pine is the best species for these soils, but any good stands of sweetgum and of commercially valuable oak should be properly managed until the trees are ready for harvesting. Then, the hardwoods can be replaced by loblolly pine. The soils of this group are not suited to yellow-poplar.

Plant competition and the equipment limitation is severe because these soils are wet throughout much of the year. Shallow rooting in these wet soils results in a moderate windthrow hazard. There is no erosion hazard.

Wildlife [3]

Wildlife is abundant in Caroline County, and the development of wildlife habitats fits in well with the other uses of the soils. The three major categories of wildlife are—

Open-land wildlife. Birds and mammals that normally frequent cropland, pastures, meadows, lawns, and areas overgrown with grasses, herbs, and shrubby growth. Examples are rabbit and quail.

Woodland wildlife. Birds and mammals that normally frequent areas of hardwood trees, coniferous trees, shrubs, and mixtures of such plants. Examples are deer, squirrel, and raccoon.

Wetland wildlife. Birds and mammals that normally frequent wet areas such as ponds, marshes, and swamps. Examples are muskrat and various kinds of waterfowl.

The areas between normal high tide and normal low tide along the 18 miles or more of river shoreline are important as feeding grounds for waterfowl, other birds, and some animals, especially raccoons. These areas can neither be indicated clearly on a map [4] nor measured accurately. They are narrow but continuous. Generally they are devoid of vegetation, or nearly so, but some areas have an abundant growth of sago pondweed, claspingleaf pondweed, widgeongrass, and pygmy spikerush. At low tide, birds and animals scavenge for dead fish and shellfish and hunt live ones. Any kind of pollution, including pollution by insecticides, damages these feeding grounds. Damage is also caused by shore erosion and by deposition of soil material washed from the uplands. Material washed from the uplands and the marshes may, however, supply food for fish.

Each year some commercial yields of fish, oysters, clams, and crabs are taken from the open waters of the rivers and ponds, which also provide fishing and hunting for many sportsmen. These waters harbor many migratory waterfowl and other waterfowl that feed in the nearby marshes and swamps. The marshes are important sources of food for fish.

ELEMENTS OF WILDLIFE HABITATS.—Vegetation, whether cultivated crops, pasture, or the natural vegetation of forests, swamps, and marshes, determines what kinds of wildlife live in a given area. The kind of vegetation that will grow depends, in large part, on the wetness of the soils.

Table 8 shows the suitability of the soils for elements of wildlife habitats. The soils are given a rating of 1, 2, 3, or 4, according to their relative suitability for the various elements. Ratings are based on the following definitions given for the elements.

Grain. Soils are rated according to their suitability for sorghum, corn, millet, soybeans, buckwheat, wheat, barley, oats, cowpeas, and other grain used as food for wildlife.

Legumes and grasses. Soils are rated according to their suitability for growing native grasses, legumes (except woody legumes), and other forage crops commonly grown in the area. Cultivated legumes and grasses valuable for wildlife food and cover include sericea lespedeza, alfalfa, alsike clover, ladino clover, red clover, tall fescue, bromegrass, and bluegrass. Native plants that are also valuable include switchgrass and other prairie grasses, partridgepeas, desmodium (beggarticks), and various native lespedezas.

Upland hardwoods. Soils are rated according to their suitability for upland hardwoods and shrubs, either native or planted, that grow vigorously and produce heavy crops of fruit or seed. Trees and shrubs that are valuable for wildlife include sumac, dogwood, persimmon, sassafras, hazelnut, shrub lespedezas, multiflora rose, autumn-olive, oak, hickory, and wild cherry.

Lowland hardwoods. Soils are rated according to their suitability for lowland hardwoods and shrubs, either native or planted, that grow vigorously and produce heavy crops of fruit or seed. Lowland trees and shrubs that are valuable for wildlife include bayberry, blueberry, huckleberry, highbush cranberry, red-osier dogwood, silky dogwood, blackhaw, sweetgum, persimmon, holly, willow oak, pin oak, and swamp white oak.

Upland conifers. Soils are rated according to their suitability for coniferous shrubs and trees that are native to or are planted on upland sites. Examples of upland conifers are Virginia pine, loblolly pine, shortleaf pine, red pine, and Norway spruce. The rating indicates that young trees will grow rapidly

[3] This section was prepared with the assistance of PHILIP F. ALLAN, biologist, Soil Conservation Service; LLOYD E. GARLAND, soil correlator, Soil Conservation Service; and CHESTER M. KERNS, chief of game management, Maryland Game and Inland Fish Commission.

[4] NICHOLSON, W. R. and VAN DEUSEN, R. D. MARSHES OF MARYLAND. Joint publication of Md. Game and Inland Fish Comm., and Md. Dept. of Res. and Ed., 1 p., illus. 1952. [Mimeographed]

TABLE 8.—*Suitability of soils for elements of wildlife habitats*

[A rating of 1 denotes well suited or above average; 2 denotes suitable or average; 3 denotes poorly suited or below average; and 4 denotes not suitable]

Soil series and map symbols	Grain	Legumes and grasses	Upland hardwoods	Lowland hardwoods	Upland conifers	Lowland conifers	Wetland plants	Shallow impoundments	Fishponds
Bayboro									
Ba	2	1	4	1	4	2	1	1	1
Bibb									
Bm	2	1	4	1	4	1	1	2	3
Elkton									
Ek, Em	2	1	4	1	4	2	1	1	1
Fallsington									
Fa, Fs	2	1	4	1	4	1	1	3	3
Galestown									
GaA, GaB, GaC, GsA, GsB	3	3	2	4	1	4	4	4	4
GaD, GaE, GaF, GsC, GsD, GsE	4	4	3	4	2	4	4	4	4
Johnston									
Jo	2	1	4	1	4	1	1	2	3
Klej									
KsA, KsB	2	2	3	1	4	1	2	3	2
Lakeland									
LaA, LaB, LaC	3	3	2	4	1	4	4	4	4
LcC	4	4	3	4	1	4	4	4	4
Matapeake									
MkA, MkB2	1	1	1	4	1	4	4	3	3
MkE	3	1	1	4	1	4	4	4	4
Mattapex									
MsA, MsB2	2	1	2	3	2	4	3	1	1
MsE	3	2	2	3	2	4	4	4	2
Mixed alluvial land									
Mt	4	4	4	2	4	2	2	1	4
Muck									
Mu	3	2	4	1	4	2	1	2	2
Othello									
Oh	2	1	4	1	4	1	1	3	2
Plummer									
Pm	3	3	4	1	4	1	1	3	2
Pocomoke									
Po, Ps	2	1	4	1	4	1	1	1	1
Portsmouth									
Pt	2	1	4	1	4	1	1	1	1
Sassafras									
SaA, SaB2, ShA, SmA, SmB, SmB2, SmC, SmC2, SnA, SnB, SnB2, SnC, SnC2, SsA, SsB	1	1	1	4	1	4	4	3	3
SmC3, SmD, SnB3, SnC3, SnD, SnD2	3	1	1	4	1	4	4	4	4
SmE, SnE, SnF	4	3	1	4	1	4	4	4	4
Swamp									
Sw	4	4	4	2	4	2	2	1	4
Tidal marsh									
Tm	4	4	4	4	4	4	1	1	4
Woodstown									
WdA, WdB2, WoA, WoB, WoB2, WoC	2	1	2	3	2	4	3	1	1

and luxuriantly, but not necessarily to timber size. A soil that is good for growing Christmas trees rates high.

Lowland conifers. Soils are rated according to their suitability for coniferous shrubs and trees that are native to or are planted on lowland sites. Examples are Atlantic white-cedar, loblolly pine, and pond pine. A high rating indicates that young trees will grow rapidly and luxuriantly, but not necessarily to timber size.

Wetland plants grown for food and cover. Soils are rated according to their suitability for growing wetland plants that provide food and cover for waterfowl and fur-bearing animals. Many of these plants are annuals or biennials, rather than perennials. Examples of wetland plants that are suitable as food for wildlife are smartweed, wildrice, barnyard grass, three-square, bulrush, spikerush, widgeongrass, rice cutgrass, pondweed, duckweed, and sedge. Cordgrass, cattail, arrow-arum, pickerelweed, buttonbush, waterwillow, and spatterdock are used primarily for cover.

Shallow impoundments. Soils are rated according to their suitability for the construction of impoundments in which the water can be controlled and kept at any level ranging from the normal water table to an average of 2 feet above the ground.

Fishponds. Soils are rated according to their suitability for the construction of ponds, either dug out or impounded, that are 6 feet deep over part of their area.

SUITABILITY OF THE SOILS FOR DIFFERENT KINDS OF WILDLIFE.—Table 9 rates the soils according to their suitability for the different kinds of wildlife in the county. The ratings are based on an average of the ratings given to elements of habitats in table 8. For example, the suitability of a given soil for waterfowl involves the consideration of its suitability for such elements of habitat as grain crops or wetland food plants and the possibility of providing shallow impoundments.

MARSH VEGETATION.—Areas of Tidal marsh in Caroline County are not suitable for crops, for pasture, or for commercially valuable trees. They are commonly used only as wildlife habitats or as recreational areas. Two types of marsh vegetation are recognized:[5] one is the cattail type, and the other is the transitional marsh type. A list of the plants that are common on the marshes is given at the end of this section.

The cattail type of vegetation covers about 1,470 acres, or about 55 percent of the acreage of Tidal marsh. It is dominant along the upper reaches of the Choptank River and Tuckahoe Creek, where there is little tidal action and the water is only slightly saline. In addition to cattails, it includes pickerelweed, wildrice, arrow-arum, spatterdock, rice cutgrass, American three-square, spikerush, sedge, wild millet, and smartweed.

There are many muskrats and various kinds of rails in areas where the cattail type of vegetation is dominant. The plants provide high-quality food for waterfowl, but there is little nesting except along the fringes of the area, where wood ducks sometimes build nests.

The transitional marsh type of vegetation covers about 1,205 acres, or 45 percent of the acreage of Tidal marsh. It is dominant along the lower reaches of the Choptank River and Tuckahoe Creek. It includes most of the plants that make up the cattail type and, in addition, many plants that have a greater tolerance for salt: Olney's three-square, saltmarsh bulrush, big cordgrass, smooth cordgrass, and marshhay cordgrass.

Muskrats are common in the areas dominated by the transitional marsh type of vegetation. During the spring and fall migrations there are many Wilson's snipe (also called jacksnipe). There are rails of many kinds, and many wintering waterfowl. Black ducks and blue-winged teal nest in these areas.

PLANTS OF THE MARSHLANDS

Common name	*Scientific name*
American three-square (also called American bulrush)	*Scirpus americanus.*
Annual wildrice	*Zizania aquatica.*
Arrow-arum	*Peltandra virginica.*
Big cordgrass	*Spartina cynosuroides.*
Common buttonbush	*Cephalanthus occidentalis.*
Common cattail	*Typha latifolia.*
Claspingleaf pondweed	*Potamogeton perfoliatus.*
Duckweed	*Lemna* spp. and *Spirodela* spp.
Marshhay cordgrass	*Spartina patens.*
Marshrose	*Rosa palustris.*
Narrowleaf cattail	*Typha angustifolia.*
Olney's three-square (also called Olney's bulrush)	*Scirpus olneyi.*
Pickerelweed	*Pontederia cordata.*
Pondweed	*Potamogeton* spp.
Rice cutgrass	*Leersia oryzoides.*
Saltmarsh bulrush	*Scirpus robustus.*
Sedge	*Carex* spp.
Smartweed	*Polygonum* spp.
Smooth cordgrass	*Spartina alterniflora.*
Spatterdock	*Nymphaea* spp.
Spikerush	*Eleocharis* spp.
Waterwillow	*Justicia americana.*
Wild millet	*Echinochloa* spp.

Engineering Uses of the Soils

This part of the soil survey report tells about the soil properties that affect engineering. The differences among soils are important in many kinds of engineering practices and projects. We cannot build a road, excavate a basement, lay a waterline or gasline, install a septic tank, make a terrace or a diversion ditch, or create an artificial pond without confronting problems resulting from soil conditions.

The information in this report was obtained by examining the soils in the field and by evaluating their characteristics with reference to engineering needs. No extensive testing was done in Caroline County, but interpretations were made by studying test data from the same kinds of soils elsewhere, particularly in Norfolk County, Va.

[5] See footnote 4 on page 31.

TABLE 9.—*Suitability of soils for wildlife*

[A rating of 1 denotes suitability with minimum management; 2 denotes suitability with average management; 3 denotes suitability only under intensive management; and 4 indicates that the soil is not suitable]

Soil series and map symbols	Suitability for—						
	Deer	Rabbit	Squirrel	Quail	Raccoon	Muskrat	Waterfowl
Bayboro							
Ba	1	1	2	1	1	1	1
Bibb							
Bm	1	1	2	1	1	1	1
Elkton							
Ek, Em	1	1	2	1	1	1	1
Fallsington							
Fa, Fs	1	1	2	1	1	2	2
Galestown							
GaA, GaB, GaC, GsA, GsB	2	2	3	3	2	4	4
GaD, GaE, GaF, GsC, GsD, GsE	3	3	3	4	3	4	4
Johnston							
Jo	1	1	2	1	1	1	1
Klej							
KsA, KsB	1	1	2	2	1	2	2
Lakeland							
LaA, LaB, LaC	2	2	3	3	2	4	4
LcC	3	3	3	4	3	4	4
Matapeake							
MkA, MkB2	1	1	2	2	2	4	4
MkE	1	1	2	3	2	4	4
Mattapex							
MsA, MsB2	2	2	2	2	2	2	2
MsE	2	2	2	3	2	3	3
Mixed alluvial land							
Mt	3	3	3	4	2	1	2
Muck							
Mu	2	3	2	4	2	1	2
Othello							
Oh	1	1	2	1	1	2	2
Plummer							
Pm	2	2	2	2	1	2	2
Pocomoke							
Po, Ps	1	1	2	1	1	1	1
Portsmouth							
Pt	1	1	2	1	1	1	1
Sassafras							
SaA, SaB2, ShA, SmA, SmB, SmB2, SmC, SmC2, SnA, SnB, SnB2, SnC, SnC2, SsA, SsB	1	1	2	1	1	3	3
SmC3, SmD, SnB3, SnC3, SnD, SnD2	1	1	2	2	2	4	4
SmE, SnE, SnF	2	2	2	3	2	4	4
Swamp							
Sw	2	3	2	4	2	1	2
Tidal marsh							
Tm	3	4	4	4	2	1	1
Woodstown							
WdA, WdB2, WoA, WoB, WoB2, WoC	2	2	2	2	2	2	2

This soil survey report contains information that engineers can use to—

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the soil properties that are important in planning agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting highway, airport, pipeline, and cable locations and in planning detailed investigations at the selected locations.
4. Locate probable sources of gravel, sand, and other construction material.
5. Correlate performances of engineering structures with soil mapping units to develop information for overall planning that will be useful in designing structures and planning certain engineering practices.
6. Determine the suitability of soil mapping units for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps, reports, and aerial photographs to make maps and reports that can be used readily by engineers.

8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

Some of the terms used by the soil scientist may not be familiar to engineers, and some words—for example, sand, silt, parent material, and structure—have special meanings in soil science. These terms, and other special terms used in this report, are defined in the Glossary at the back of this report.

It is not intended that the information in this section be used directly for engineering design. The facts and estimates given here are at best a guide; engineering design should be based on field surveys and on the analyses of samples taken from construction sites. The information in this section shows, for example, that the subsoil of Bayboro silt loam is not suitable for use as fill material that must support a heavy load. It also shows that the subsoil of the Sassafras loams is generally suitable for earthen dams for small ponds. It does not show, however, just how good the subsoil is for earthen dams or small ponds in any particular area of Sassafras soils. Tests at the site will be necessary to obtain this information.

Engineering classification systems

Two systems of classifying soils are in general use among engineers. Both are used in this report.

Most highway engineers classify soil materials in accordance with the system approved by the American Association of State Highway Officials (AASHO).[6] In this system, classification is based on the physical properties of the soil materials and the field performance of the soils in highways. All soils are classified in seven principal groups. The groups range from A–1 (gravelly soils of high bearing capacity) to A–7 (clay soils having low strength when wet). Within each group, the relative engineering value of the soil material is indicated by a group index number. Group indexes range from 0 for the best materials to 20 for the poorest. The group index number, when used, is shown in parentheses after the soil group symbol, for example, A–2–4(0).

Some engineers prefer to use the Unified soil classification system established by the Waterways Experiment Station, Corps of Engineers.[7] This system is based on identification of soils according to their performance as engineering construction materials. Soil materials are identified as coarse grained (8 classes), fine grained (6 classes), or highly organic. Estimated classifications of major horizons of the soils in Caroline County, under both systems, are given in table 10.

Soil properties and engineering interpretations

The information and interpretations of most significance to engineers are presented in tables 10 and 11. Additional information can be found in these sections of the report: "Descriptions of the Soils," "General Soil Map," and "Physiography, Relief, and Drainage." Brief explanations of how the information in the tables was obtained and of the significance of some of the items follows.

[6] American Association of State Highway Officials. Standard specifications for highway materials and methods of sampling and testing. Ed. 7, 2 v., 257 and 514 pp., illus. 1955.

[7] Waterways Experiment Station, Corps of Engineers. The unified soil classification system. Tech. Memo. No. 3–357, 2 v. and app., 44 pp., illus. 1953.

Estimated Properties of the Soils.—Table 10 gives brief descriptions of the pertinent characteristics of the soils of each series and estimates of some of the physical properties that affect engineering work. The properties are those of the typical soil profiles, which are divided into layers significant to engineering. Descriptions of color and other characteristics not important to engineering have been omitted.

Unless otherwise indicated, the descriptions of physical properties apply to the soils that are but little eroded, but in some places the degree of erosion, the content of gravel, and other items are indicated.

The thickness of the soil horizons varies somewhat from place to place. The thickness and other properties described in the table are properties that actually exist in a specific profile of the soil described. In a soil that is severely eroded, little, if any, of the original surface layer remains and the underlying horizons are closer to the surface than is indicated in the table.

The rate of permeability is based on the movement of water through the undisturbed soil material. The rate depends largely upon the texture and structure of the soil.

The shrink-swell potential is an indication of the volume change to be expected with a change in moisture content. It is estimated primarily on the basis of the amount and type of clay present. In general, soils classified as CH and A–7 have a high shrink-swell potential. Clean sands and gravels (single-grain structure) and those having small amounts of nonplastic to slightly plastic fines, as well as most other nonplastic to slightly plastic soil material, have a low shrink-swell potential.

Interpretations of Engineering Properties.—Table 11 gives estimates of the suitability of the soils of Caroline County for highway construction and for specified engineering uses. Statements in this table are based on information given in table 10 and represent the judgment and opinions of engineers and soil scientists who have worked in the field.

The rating as to suitability for winter (or wet weather) grading applies only to the soil material. Bedrock occurs at such a great depth that it is not encountered in normal grading operations. The rating for winter grading depends largely on the texture of the soil material, its natural water content, and the depth to the water table. Clay soils are difficult to handle when wet and must be dried to proper moisture content for compaction. Clay soils that have a high water table and are highly plastic, and soils that are highly organic, are rated not suitable. Some clay soils that have a high water table and are moderately plastic, and some soils that are silty, are rated poor.

The rating of susceptibility to frost action refers to detrimental effects of freezing and thawing as related to construction uses of the soil. It depends on the texture of the soil material and the depth to the water table during the freezing period. Silts and fine sands with a high water table are rated high.

The rating as to the general suitability of the soils as fields for septic tanks may help those who are selecting a homesite and those who are investigating the suitability of an area for real estate development. Under the heading "Sewage Disposal Groups," the soils are grouped according to their suitability as fields for septic tanks and the factors that limit and those that favor the functioning of septic tanks are indicated for each group.

TABLE 10.—*Brief descriptions of soils and their*

[Dashes indicate information

Map symbol	Mapping unit	Depth to seasonally high water table	Brief description of soil and site	Depth from surface (typical profile)
		Feet		*Inches*
Ba	Bayboro silt loam.	0	Very poorly drained soil in depressions; high in organic matter; developed in fine-textured sediments. Very wet; may be temporarily ponded.	0 to 7 7 to 16 16 to 44 44 to 50
Bm	Bibb silt loam.	0 to 1	Poorly drained soils on flood plains; developing in general alluvium from Coastal Plain sediments. Wet; subject to flooding.	0 to 41 41 to 50
Ek Em	Elkton loam. Elkton silt loam.	0 to 1	Poorly drained soils; developed in moderately fine textured to fine textured sediments. Wet; may be temporarily ponded.	0 to 10 10 to 44 44 to 60
Fa Fs	Fallsington loam. Fallsington sandy loam.	0 to 1	Poorly drained soils that have a moderately fine textured subsoil; developed in coarse-textured sediments. Wet; may be temporarily ponded.	0 to 6 6 to 24 24 to 35 35 to 50
GaA GaB GaC GaD GaE GaF	Galestown loamy sand, 0 to 2 percent slopes. Galestown loamy sand, 2 to 5 percent slopes. Galestown loamy sand, 5 to 10 percent slopes. Galestown loamy sand, 10 to 15 percent slopes. Galestown loamy sand, 15 to 30 percent slopes. Galestown loamy sand, 30 to 60 percent slopes.	5+	Somewhat excessively drained to excessively drained, deep, very sandy soils; developed in coarse-textured sediments; wind-worked in places.	0 to 40 40 to 60 60 +
GsA GsB GsC GsD GsE	Galestown sand, 0 to 2 percent slopes. Galestown sand, 2 to 5 percent slopes. Galestown sand, 5 to 10 percent slopes. Galestown sand, 10 to 15 percent slopes. Galestown sand, 15 to 30 percent slopes.	5+	Excessively drained, deep, extremely sandy soils; developed in coarse-textured sediments; wind-worked in places.	0 to 60 60 +
Jo	Johnston loam.	0	Very poorly drained soils on flood plains; developing in general alluvium from Coastal Plain sediments. Very wet; subject to flooding.	0 to 27 27 to 37 37 to 50
KsA KsB	Klej loamy sand, 0 to 2 percent slopes. Klej loamy sand, 2 to 5 percent slopes.	2	Moderately well drained to somewhat poorly drained, very sandy soils; developed in coarse-textured sediments. Temporarily wet.	0 to 40 40 to 50
LaA LaB LaC	Lakeland loamy sand, clayey substratum, 0 to 2 percent slopes. Lakeland loamy sand, clayey substratum, 2 to 5 percent slopes. Lakeland loamy sand, clayey substratum, 5 to 10 percent slopes.	5+	Somewhat excessively drained to excessively drained, deep, very sandy soils; developed in coarse-textured sediments; wind-worked in places.	0 to 20 20 to 60 60 to 72
LcC	Lakeland sand, clayey substratum, 2 to 10 percent slopes.	5+	Excessively drained, deep, extremely sandy soils; developed in coarse-textured sediments; wind-worked in places.	0 to 60 60 to 72
MkA MkB2 MkE	Matapeake silt loam, 0 to 2 percent slopes. Matapeake silt loam, 2 to 5 percent slopes, moderately eroded. Matapeake silt loam, 15 to 30 percent slopes.	5+	Well-drained, deep soils; developed in a silty mantle over sandy Coastal Plain sediments.	0 to 9 9 to 37 37 to 48
MsA MsB2 MsE	Mattapex silt loam, 0 to 2 percent slopes Mattapex silt loam, 2 to 5 percent slopes, moderately eroded. Mattapex silt loam, 15 to 30 percent slopes.	2	Moderately well drained soils; developed in a silty mantle over sandy Coastal Plain sediments. Temporarily wet.	0 to 10 10 to 35 35 to 49

estimated properties significant to engineering

not available or not applicable]

Engineering classification		Grain sizes—			Characteristics significant in engineering		
Unified	AASHO	Passing No. 4 sieve	Passing No. 10 sieve	Passing No. 200 sieve	Permeability	Reaction	Shrink-swell potential
		Percent	*Percent*	*Percent*	*Inches per hour*	*pH*	
ML or OL	A–4 or A–5	100	100	60 to 80	<0. 20	4. 5 to 5. 0	Low to moderate.
CL or OL	A–6 or A–5	100	100	65 to 85	<0. 20	4. 0 to 4. 5	Moderate.
CH	A–7	100	100	75 to 95	<0. 20	4. 5 to 5. 0	High.
SP–SM	A–2 or A–3	100	100	5 to 15	2. 0 to 6. 3	4. 5 to 5. 0	Low.
ML	A–4	100	100	60 to 70	<0. 20	4. 0 to 5. 0	Low.
SM	A–2	100	100	15 to 30	0. 20 to 2. 0	4. 0 to 4. 5	Low.
ML or CL	A–4 or A–6	100	100	50 to 80	<0. 20	4. 0 to 5. 0	Moderate.
CL or CH	A–6 or A–7	100	100	80 to 90	<0. 20	4. 0 to 5. 0	Moderate to high.
SM	A–2	100	100	10 to 25	0. 20 to 0. 63	4. 0 to 4. 5	Low.
SM	A–4	100	100	35 to 50	0.20 to 0.63	4.0 to 4.5	Low.
SC	A–2 or A–6	100	100	25 to 45	0.20 to 0.63	4.0 to 4.5	Moderate to low.
SM	A–2	100	95 to 100	15 to 30	0.63 to 2.0	4.0 to 4.5	Low.
SP or SM	A–3 or A–2	95 to 100	90 to 100	5 to 20	2.0 to 6.3	4.0 to 4.5	Low.
SM	A–2	100	100	10 to 20	2.0 to 6.3	4.0 to 5.5	Low
SP or SP–SM	A–3	100	100	0 to 10	>6.3	4.0 to 4.5	Low.
SC or SM	A–2	100	100	15 to 30	0.63 to 2.0	4.0 to 4.5	Low.
SP or SP–SM	A–3	100	100	0 to 10	>6.3	4.0 to 5.5	Low.
SC or SM	A–2	100	100	15 to 30	0.63 to 2.0	4.0 to 4.5	Low.
SM or OL	A–4	100	100	35 to 50	<0. 20	4. 0 to 4. 5	Low.
SM	A–2 or A–4	100	100	25 to 45	0. 20 to 0. 63	4. 0 to 4. 5	Low.
SM	A–2	95 to 100	90 to 100	15 to 20	0. 63 to 2. 0	4. 0 to 4. 5	Low.
SM	A–2	100	100	10 to 20	2. 0 to 6. 3	4. 5 to 5. 5	Low.
SC	A–2	100	100	15 to 30	<0. 20	4. 0 to 4. 5	Moderate.
SM	A–2	100	100	10 to 20	2. 0 to 6. 3	4. 5 to 5. 5	Low.
SP or SP–SM	A–3	100	100	0 to 10	>6. 3	4. 5 to 5. 0	Low.
SM	A–2	90 to 100	95 to 100	15 to 25	0. 63 to 2. 0	4. 5 to 5. 0	Low.
SP or SP-SM	A–3	100	100	0 to 10	>6. 3	4. 5 to 5. 5	Low.
SM	A–2	90 to 100	95 to 100	15 to 25	0. 63 to 2. 0	4. 5 to 5. 0	Low.
ML	A–4	100	100	60 to 80	0. 63 to 2. 0	6. 1 to 7. 0	Low.
CL	A–6	100	100	65 to 85	0. 20 to 0. 63	5. 1 to 6. 0	Moderate.
SM	A–2	90 to 100	95 to 100	15 to 30	0. 63 to 2. 0	4. 6 to 5. 5	Low.
ML	A–4	100	100	60 to 80	0. 63 to 2. 0	5. 1 to 6. 0	Low.
CL	A–6	100	100	65 to 85	<0. 20	4. 6 to 5. 5	Low.
SM	A–2	90 to 100	95 to 100	15 to 30	0. 63 to 2. 0	4. 6 to 5. 0	Moderate.

TABLE 10.—*Brief descriptions of soils and their estimated*

[Dashes indicate information not

Map symbol	Mapping unit	Depth to seasonally high water table	Brief description of soil and site	Depth from surface (typical profile)
		Feet		*Inches*
Mt	Mixed alluvial land	0 to 1	Mixed soils on flood plains; mostly poorly drained. Wet; subject to flooding.	
Mu	Muck	0	Organic soil in depressions; overlies a sandy substratum. Very wet.	0 to 34 34 to 50
Oh	Othello silt loam	0 to 1	Poorly drained soil; developed in silty mantle over sandy Coastal Plain sediments. Wet; may be temporarily ponded.	0 to 8 8 to 21 21 to 26 26 to 36
Pm	Plummer loamy sand	0 to 1	Poorly drained very sandy soil; developed in coarse-textured sediments. Wet; may be temporarily ponded.	0 to 14 14 to 48
Po Ps	Pocomoke loam. Pocomoke sandy loam.	0	Very poorly drained soils that have a moderately fine textured subsoil; developed in coarse-textured sediments. Very wet; may be temporarily ponded; surface grades to OL.	0 to 11 11 to 31 31 to 48
Pt	Portsmouth silt loam.	0	Very poorly drained soil; developed in a silty mantle over sandy Coastal Plain sediments. Very wet; may be temporarily ponded.	0 to 8 8 to 26 26 to 44 44 to 60
SaA SaB2 SnA SnB SnB2 SnB3 SnC SnC2 SnC3 SnD SnD2 SnE SnF	Sassafras loam, 0 to 2 percent slopes. Sassafras loam, 2 to 5 percent slopes, moderately eroded. Sassafras sandy loam, 0 to 2 percent slopes. Sassafras sandy loam, 2 to 5 percent slopes. Sassafras sandy loam, 2 to 5 percent slopes, moderately eroded. Sassafras sandy loam, 2 to 5 percent slopes, severely eroded. Sassafras sandy loam, 5 to 10 percent slopes. Sassafras sandy loam, 5 to 10 percent slopes, moderately eroded. Sassafras sandy loam, 5 to 10 percent slopes, severely eroded. Sassafras sandy loam, 10 to 15 percent slopes. Sassafras sandy loam, 10 to 15 percent slopes, moderately eroded. Sassafras sandy loam, 15 to 30 percent slopes. Sassafras sandy loam, 30 to 60 percent slopes.	5+	Well-drained soils that have a moderately fine textured subsoil; developed in sandy Coastal Plain sediments.	0 to 6 6 to 33 33 to 40 40 to 50
ShA SsA SsB	Sassafras loam, heavy substratum, 0 to 2 percent slopes. Sassafras sandy loam, heavy substratum, 0 to 2 percent slopes. Sassafras sandy loam, heavy substratum, 2 to 5 percent slopes.	5+	Well-drained soils that have a moderately fine textured subsoil; developed in sandy Coastal Plain sediments; the substratum consists of massive, sandy clays and sand-clay mixtures; in places there are thin lenses of sand in the substratum.	0 to 6 6 to 33 33 to 40 40 to 50
SmA SmB SmB2 SmC SmC2 SmC3 SmD SmE	Sassafras loamy sand, 0 to 2 percent slopes. Sassafras loamy sand, 2 to 5 percent slopes. Sassafras loamy sand, 2 to 5 percent slopes, moderately eroded. Sassafras loamy sand, 5 to 10 percent slopes. Sassafras loamy sand, 5 to 10 percent slopes, moderately eroded. Sassafras loamy sand, 5 to 10 percent slopes, severely eroded. Sassafras loamy sand, 10 to 15 percent slopes. Sassafras loamy sand, 15 to 30 percent slopes.	5+	Well-drained, deep, sandy soils that have a thin, moderately fine textured subsoil; developed in coarse-textured sediments; wind-worked in places.	0 to 26 26 to 32 32 to 50

properties significant to engineering—Continued

available or not applicable]

Engineering classification		Grain sizes—			Characteristics significant in engineering		
Unified	AASHO	Passing No. 4 sieve	Passing No. 10 sieve	Passing No. 200 sieve	Permeability	Reaction	Shrink-swell potential
		Percent	*Percent*	*Percent*	*Inches per hour*	*pH*	
SM, ML, CL	A 2, A-4, A-6						Low to moderate.
Pt or OH							Moderate to high.
SP or SM	A-3 or A-2	100	100	5 to 15	2. 0 to 6. 3	4. 0 to 4. 5	Low.
ML	A-4	100	100	60 to 80	0. 20 to 0. 63	4. 6 to 5. 0	Low.
CL	A-6	100	100	65 to 85	<0. 20	4. 0 to 5. 0	Moderate.
SM	A-2	90 to 100	95 to 100	15 to 25	0. 20 to 0. 63	4. 6 to 5. 0	Low.
SP or SM	A-2 or A-3	90 to 100	95 to 100	5 to 15	2. 0 to 6. 3	4. 0 to 5. 0	Low.
SM	A-3 or A-2	100	100	10 to 20	>6. 3	4. 0 to 5. 0	Low.
SP or SP-SM	A-3	100	100	0 to 10	>6. 3	4. 0 to 4. 5	Low.
ML or SM	A-4 or A-2	100	100	30 to 50	0. 63 to 2. 0	4. 0 to 4. 5	Low.
SC	A-6	100	100	35 to 50	0. 20 to 0. 63	4. 0 to 4. 5	Moderate.
SP or SM	A-3 or A-2	95 to 100	90 to 100	5 to 20	2. 0 to 6. 3	4. 0 to 4. 5	Low.
ML or OL	A-4	100	100	60 to 80	0. 20 to 0. 63	4. 6 to 5. 0	Low to moderate.
CL or CH	A-6 or A-7	100	100	70 to 90	<0. 20	4. 0 to 5. 0	Moderate to high.
SM or SP-SM	A-2 or A-3	95 to 100	90 to 100	10 to 20	0. 63 to 2. 0	4. 0 to 4. 5	Low.
SC	A-6	95 to 100	90 to 100	30 to 50	<0. 20	4. 0 to 5. 0	Moderate to high.
SM or ML	A-2 or A-4	95 to 100	90 to 100	30 to 50	2. 0 to 6. 3	4. 6 to 5. 0	Low.
SC	A-2 or A-6	95 to 100	90 to 100	25 to 45	0. 20 to 0. 63	4. 6 to 5. 0	Moderate.
SM	A-2	95 to 100	90 to 100	15 to 25	0. 63 to 2. 0	4. 6 to 5. 0	Low.
SM or SP	A-2 or A-3	95 to 100	90 to 100	5 to 15	2. 0 to 6. 3	4. 6 to 5. 0	Low.
SM or ML	A-2 or A-4	95 to 100	90 to 100	30 to 50	2.0 to 6.3	4.6 to 5.0	Low.
SC	A-2 or A-6	95 to 100	90 to 100	25 to 45	0.20 to 0.63	4.6 to 5.0	Moderate.
SM	A-2	95 to 100	90 to 100	15 to 25	0.63 to 2.0	4.6 to 5.0	Low.
SC	A-2 or A-6	95 to 100	90 to 100	25 to 45	0.20 to 0.63	4.6 to 5.0	Moderate.
SM	A-2	100	100	10 to 20	2.0 to 6.3	4.6 to 5.5	Low.
SM or SC	A-2 or A-4	100	100	25 to 45	0.20 to 0.63	4.6 to 5.0	Moderate to low.
SP or SM	A-3 or A-2	95 to 100	90 to 100	5 to 15	>6.3	4.6 to 5.0	Low.

TABLE 10.—*Brief description of soils and their*

[Dashes indicate information

Map symbol	Mapping unit	Depth to seasonally high water table	Brief description of soil and site	Depth from surface (typical profile)
		Feet		*Inches*
Tm	Tidal marsh	0	Unclassified soil material; brackish to saline; flooded by high tides.	
WdA	Woodstown loam, 0 to 2 percent slopes	2	Moderately well drained soils that have a moderately fine textured subsoil; developed in sandy Coastal Plain sediments. Temporarily wet.	0 to 8
WdB2	Woodstown loam, 2 to 5 percent slopes, moderately eroded.			8 to 24
WoA	Woodstown sandy loam, 0 to 2 percent slopes.			24 to 44
WoB	Woodstown sandy loam, 2 to 5 percent slopes.			44 to 50
WoB2	Woodstown sandy loam, 2 to 5 percent slopes, moderately eroded.			50 to 60
WoC	Woodstown sandy loam, 5 to 10 percent slopes.			

Road fill is the embankment used to reduce grade and, in some cases, to provide drainage for the completed road. The suitability of the soil material for road fill depends largely on its texture and its natural water content. Wet and highly plastic soil material and soil material that is highly organic are rated not suitable. Wet and moderately plastic soil material is rated poor. These ratings depend on the natural water content and the difficulty of handling, drying, and compacting the soil material. Therefore, the wet, sandy soils that can be readily drained before excavation is started and sandy soils that are normally wet in their natural condition but dry readily when excavated are rated fair. Soils that are susceptible to erosion, such as those composed primarily of fine sands or silt, are rated poor to fair.

Topsoil is surface soil material that is high in organic-matter content. It is used to topdress roadsides, gardens, and lawns.

A soil may be suitable for one engineering purpose, but it may be poor or even not suitable for some other use. For example, the soils of the Woodstown series are considered fair as a source of material for road fill, good as a source of topsoil, and not suitable for use as fields for septic tanks. The soils of the Galestown series, though rated fair as a source of material for road fill and fair as a source of topsoil, are rated good as fields for septic tanks. A subsoil of fine silty clay, such as that in the soils of the Portsmouth series, generally indicates that the soil is suitable as a site for a pond or reservoir, but poor for an embankment or dam. A fine-textured subsoil increases the difficulty of adequately draining a soil and limits its suitability for irrigation.

In some soils in Caroline County, highway gradelines can be located anywhere on or in the soil. In other soils a high water table, flooding, high plasticity, high shrink-swell potential, instability, or presence of seepage zones have to be considered in determining the position of the gradeline.

Table 11 rates the soils as to suitability for sprinkler irrigation. Under the heading "Irrigation Groups," the better agricultural soils of the county are grouped according to their suitability for sprinkler irrigation, and factors affecting their suitability are discussed.

Table 11 lists either the good or the undesirable soil features that affect the choice of site, the design, and the installation of conservation structures. It also lists the type of farm pond suitable for each soil series.

The interpretations in table 11 are general, but they point out what the engineer can expect to find in any area of soil that is shown on the detailed map. However, the interpretations do not take the place of examination and evaluation of the soil at the exact site of a planned engineering project.

Irrigation groups

Rainfall in Caroline County normally is adequate for agricultural purposes but is not always well distributed. Extended dry periods may occur between June and September. If an irrigation system and an adequate supply of water were readily available in periods of drought, yields would not be reduced.

In this section, the better agricultural soils are grouped according to characteristics that significantly affect their suitability for conservation irrigation. Conservation irrigation is the application of irrigation water in the amounts needed to maintain the production of crops at a high level without waste of water and without damage to the soil. All irrigation referred to in this section is by sprinkler system.

This section is not intended to be a guide for the design of sprinkler irrigation systems. Such a guide has been compiled for the State of Maryland.[8] The facts in this section are based on the best information available concerning the soils, water supply, climate, crops, and farming conditions in the county. It can be used as a general reference but will not substitute for an on-site investigation.

To be suitable for irrigation, soils must have good drainage. Some moderately well drained soils are included in the irrigation groups, but they should be artificially

[8] UNITED STATES DEPARTMENT OF AGRICULTURE. MARYLAND GUIDE FOR SPRINKLER IRRIGATION DESIGN. (In cooperation with the Md. Agr. Ext. Serv. and Md. Agr. Expt. Sta.) 17 pp. 1955. [Unpublished]

estimated properties significant to engineering—Continued

not available or not applicable]

Engineering classification		Grain sizes—			Characteristics significant in engineering		
Unified	AASHO	Passing No. 4 sieve	Passing No. 10 sieve	Passing No. 200 sieve	Permeability	Reaction	Shrink-swell potential
		Percent	*Percent*	*Percent*	*Inches per hour*	*pH*	
SM to CH	A-2 to A-7						Low to high.
SM	A-2 or A-4	100	100	30 to 50	2.0 to 6.3	5.1 to 5.5	Low.
SM or SC	A-2 or A-4	95 to 100	90 to 100	25 to 45	0.20 to 0.63	4.6 to 5.5	Low to moderate.
SP or SM	A-2 or A-3	95 to 100	90 to 100	5 to 15	2.0 to 6.3	4.6 to 5.0	Low.
SC or CL	A-2 or A-6	95 to 100	90 to 100	30 to 50	<0.20	4.6 to 5.0	Moderate to high.
SP-SM	A-3	95 to 100	90 to 100	5 to 10	6.3	4.6 to 5.0	Low.

drained if they are irrigated. Soils that are severely eroded and those that are poorly drained or very poorly drained are not included.

If conservation irrigation is practiced, it should be part of a complete farm program of soil and water conservation. Irrigation is expensive and should be used only on soils that are highly productive and that can be made more productive by irrigation. These soils should be liberally fertilized and adequately limed. The cropping systems should include crops that will help control erosion, minimize leaching, maintain good tilth, and furnish organic matter. For these reasons, only the soils that are suitable for regular cultivation are included in the irrigation groups.

Irrigating an extensive area requires a large amount of water. The water supply should be adequate to maintain optimum moisture in the soil during a prolonged dry period. A common mistake is to attempt irrigation with too little water. An ordinary farm pond will not supply enough water to irrigate anything except a very small home garden.

Water for irrigation may be supplied by wells, streams, or reservoirs. A permit to drill an irrigation well or to construct a pond or reservoir must be obtained from the State Department of Geology, Mines, and Water Resources, Johns Hopkins University, Baltimore, Md. This department also supplies information about the supply of ground water in a specific area in the State. Drilling a test well, to determine if an adequate supply of water is available, is a good practice. Only streams that have a constant flow during extended droughts and that have not been contaminated by salt water are suitable sources of water for irrigation. The streamflow should be measured in a period of drought to determine if sufficient water would be available for irrigation. The storage capacity of a surface reservoir must be large enough to meet crop needs in the irrigation season and to make up for losses caused by evaporation and seepage. Generally, ½ to 1 acre-foot of stored water is needed for each acre to be irrigated. A reservoir of smaller capacity can be used if it can be refilled between irrigations.

The quality of water must also be determined. If the suitability of the water is questioned, samples can be sent to the State Soil Testing Laboratory, Agronomy Department, University of Maryland, College Park, Md. The laboratory can analyze the water for acidity, salt content, or other characteristics that might be harmful to crops. Runoff water may carry certain plant diseases that can infect susceptible crops if the water is impounded in reservoirs and used for irrigation. The red stole disease of strawberries, for example, can be transmitted in this way. Runoff water from areas where strawberries have been grown should not be used to irrigate other strawberry fields.

Laws and regulations govern the use of water from streams and wells. The landowner who plans to use water for irrigation from a channelized stream should obtain information regarding his rights and obligations from a qualified source before investing in irrigation equipment.

To be successful, irrigation must meet the needs of both crops and soils. Different crops need different amounts of water applied at different intervals. Some soils hold much water, and others hold little; some soils absorb water readily, and others absorb it slowly.

Each irrigation group shown in table 12 consists of soils that are similar in the characteristics that affect their suitability for irrigation. The table shows, for different crops, the rate at which water can be applied without waste and without damage to the soil, the depth to which the soil should be irrigated, and the amount of water the soil can supply to crops.

Truck groups 1, 2, and 3, referred to in table 12, consist of the following:

Truck group 1	Truck group 2	Truck group 3
Very shallow rooted crops	*Shallow rooted crops*	*Moderately deep rooted crops*
Lettuce.	Beets.	Asparagus.
Onions.	Broccoli.	Eggplant.
Spinach.	Cabbage.	Lima beans.
Strawberries.	Cauliflower.	Melons.
	Celery.	Peppers.
	Cucumbers.	Pumpkins.
	Peas.	Squash.
	Snap beans.	

TABLE 11.—*Interpretations of*

[Muck and Made land are not rated. Muck is highly organic and generally not suitable for the uses shown.

Soil series and map symbols	Suitability for winter and wet weather grading	Susceptibility to frost action	Suitability for septic tank filter fields [1]	Suitability as source of—		
				Road fill	Topsoil [2]	Sand [3]
Bayboro (Ba)	Not suitable	Very high	Not suitable	Not suitable	Fair	Not suitable
Bibb (Bm)	Not suitable	High	Not suitable	Not suitable	Fair	Not suitable
Elkton (Ek, Em)	Not suitable	High	Not suitable	Not suitable	Poor	Not suitable
Fallsington (Fa, Fs)	Poor	High	Not suitable	Fair	Fair	Good at depth of more than 2 feet; poor above.
Galestown (GaA, GaB, GaC, GaD, GaE, GaF, GsA, GsB, GsC, GsD, GsE).	Fair to good	Low	Good	Fair	Fair	Good
Johnston (Jo)	Not suitable	High	Not suitable	Poor	Fair	Good
Klej (KsA, KsB)	Fair to good	Moderate	Not suitable	Fair	Fair	Fair
Lakeland (LaA, LaB, LaC, LcC)	Fair to good	Low	Good	Fair	Fair	Good
Matapeake (MkA, MkB2, MkE)	Not suitable	Moderate	Good	Good	Good	Good at depth of more than 3 feet; not suitable above.
Mattapex (MsA, MsB2, MsE)	Not suitable	High	Not suitable	Poor	Fair	Good at depth of more than 3 feet; not suitable above.
Mixed alluvial land (Mt)	Not suitable	High	Not suitable	Poor	Poor	
Othello (Oh)	Not suitable	High	Not suitable	Poor	Poor	Good at depth of more than 2 feet; poor above.
Plummer (Pm)	Poor to fair	Moderate	Not suitable	Poor	Poor	Fair
Pocomoke (Po, Ps)	Very poor	Very high	Not suitable	Fair	Fair	Good at depth of more than 3 feet; not suitable above.
Portsmouth (Pt)	Not suitable	Very high	Not suitable	Poor	Fair	Fair to good at depth of more than 2 feet; not suitable above.
Sassafras (SaA, SaB2, ShA, SmA, SmB, SmB2, SmC, SmC2, SmC3, SmD, SmE, SnA, SnB, SnB2, SnB3, SnC, SnC2, SnC3, SnD, SnD2, SnE, SnF, SsA, SsB).	Poor to fair	Moderate	Good	Good	Good	Good [7]
Swamp (Sw)	Not suitable		Not suitable	Not suitable		Not suitable
Tidal marsh (Tm)	Not suitable	High	Not suitable	Not suitable		Not suitable
Woodstown (WdA, WdB2, WoA, WoB, WoB2, WoC).	Poor to fair	High	Not suitable	Fair	Good	Good at depth of more than 2 feet; poor above.

[1] Ratings applicable only for slopes of less than 5 percent.
[2] Rating is for surface layer (A1 or Ap horizon) only.
[3] Some soils suitable as sources of sand have gravel in the substratum in places; site investigation is necessary.
[4] Rating is for surface layer only.
[5] Farm ponds may be excavated if the level of the water in the pond does not have to be kept higher than the natural water table of the soil.

engineering properties of the soils

Made land is too variable to be rated. Dashes indicate information not available or not applicable]

Desired location of road gradeline	Suitability for sprinkler irrigation	Soil features affecting—				Suitable type of farm pond
		Farm ponds		Drainage systems	Waterways [4]	
		Reservoir area	Embankment			
A minimum of 5 feet above the surface of the ground.	Not suitable	Very slowly permeable.	Very poor stability.	Very slowly permeable.	Highly erodible	Excavated.
A minimum of 3 feet above the high-water level.	Poor	Slowly permeable.	Poor stability.	Slowly permeable.	Highly erodible	Excavated or impounded.
A minimum of 4 feet above the water table.	Very poor	Very slowly permeable.	Poor stability.	Very slowly permeable.	Highly erodible	Excavated or impounded.
A minimum of 4 feet above the water table.	Fair	Permeable substratum.	Sandy substratum.	Permeable substratum.	Erodible	Excavated or impounded.[5]
Anywhere, if surface drainage is provided.	Good	Rapidly permeable.	Loose, permeable.	Not needed	Erodible	
A minimum of 3 feet above the high-water level.	Poor	Permeable substratum.	Sandy substratum.	Permeable substratum.	Erodible	Impounded.
A minimum of 4 feet above the water table.	Fair	Permeable substratum.	Sandy substratum.	Permeable substratum.	Erodible	Impounded.[5]
Anywhere, if surface drainage is provided.	Good	Rapidly permeable.	Loose, permeable.	Not needed	Erodible	
Anywhere, if surface drainage is provided.	Good	Permeable substratum.	Sandy substratum.	Not needed	Erodible	Impounded.
A minimum of 4 feet above the water table.	Fair	Permeable substratum.	Sandy substratum.	Permeable substratum.	Erodible	Impounded.
A minimum of 3 feet above the high-water level.	Not suitable	Variable	Variable	Variable	Erodible	Impounded.[5]
A minimum of 4 feet above the water table.	Poor	Permeable substratum.	Sandy substratum.	Permeable substratum.	Highly erodible	Impounded.[5]
A minimum of 4 feet above the water table.	Poor	Rapidly permeable.	Loose, permeable.	Permeable substratum.	Erodible	Excavated.[5]
A minimum of 4 feet above the water table.	Fair	Permeable substratum.	Sandy substratum.	Permeable substratum.	Erodible	Excavated or impounded.[5]
A minimum of 4 feet above the water table.	Fair	Permeable substratum.	Sandy substratum.	Permeable substratum.	Erodible	Excavated or impounded.
Anywhere, if surface drainage is provided.	Good	Permeable substratum.[7]	Sandy substratum.[7]	Not needed	Erodible	Impounded.
A minimum of 3 feet above the high-water level.	Not suitable			Impractical		
A minimum of 2 feet above high tide.[8]	Not suitable		Very poor stability.	Impractical		
A minimum of 4 feet above the water table.	Fair to good	Permeable substratum.	Sandy substratum.	Permeable substratum.	Erodible	Impounded.

[6] Farm ponds may be excavated if the substratum is not highly permeable.

[7] The heavy substratum phases of the Sassafras soils are not suitable as a source of sand. The heavy substratum is more suitable for reservoir areas and for embankment material.

[8] Road embankments in areas of Tidal marsh need protection from the erosion caused by wave action or extremely high tides.

Tomatoes, Irish potatoes, and a few other truck crops are listed separately in table 12, but all other truck crops are shown in truck crop groups 1, 2, or 3. Grass mixtures may include any of several grasses commonly used for pasture or hay, grown with or without legumes. Orchards include apple, peach, pear, cherry, plum, prune, and pecan. "Orchard with cover" indicates that a close-growing crop covers the soil between the trees. "Orchard without cover" indicates that the soil between the trees is bare or nearly so.

IRRIGATION GROUP 1

The sandiest soils in the county are in this group. These soils can be irrigated at a rapid rate but will retain less moisture than the other soils in the county. Irrigation water should be applied frequently and in relatively small amounts.

IRRIGATION GROUP 2

The soils in this group have a thick sandy surface layer similar to that of the soils in group 1. They have a thin to moderately thick, finer textured subsoil. As a result, these soils have a slightly greater moisture-holding capacity below a depth of about 18 inches than the soils in group 1. For most crops, irrigation water should be applied more slowly on these soils than on the soils in group 1.

IRRIGATION GROUP 3

The soils in this group have a surface layer of sandy loam, and in most places the subsoil is light sandy clay loam. The subsoil is moderately permeable and has a rather high available moisture capacity. In most places these soils are underlain by sandy material below a depth of about 30 inches, but in some places they are underlain by a heavier, clayey material. The level or nearly level soils can be irrigated at a moderate rate, ranging from six-tenths of an inch per hour in clean-cultivated areas to about 1 inch per hour where the surface is protected by vegetation.

IRRIGATION GROUP 4

The soils in this group have a somewhat finer textured surface layer, and in some places the subsoil is finer textured than that of the soils in group 3. These soils retain larger amounts of water than the sandier soils but must be irrigated more slowly. The soils in this group are among the best agricultural soils for most purposes in the county. Because of their high available moisture capacity, they need irrigation less frequently during dry periods than most soils of the county.

TABLE 12.—*Irrigation groups, suitable crops, and certain water relationships*

[Generally, only moderately well drained to somewhat excessively drained soils that are suited to regular cultivation are suitable for irrigation, but there are some exceptions]

Irrigation groups and soils	Estimated maximum rate of application on level and nearly level soils [1]	Suitable crops	Estimated average depth to be irrigated	Estimated average available moisture capacity [2]
	In. per hr.		*In.*	*In.*
Group 1: Moderately well drained to excessively drained sands and loamy sands that are 36 or more inches deep.	1.0	Truck group 1	18	1.5
Galestown loamy sand, 0 to 2 percent slopes.	1.0	Truck group 2	24	2.0
Galestown loamy sand, 2 to 5 percent slopes.	1.0	Truck group 3	30	2.5
Galestown loamy sand, 5 to 10 percent slopes.	1.0	Corn	27	2.3
Galestown sand, 0 to 2 percent slopes.	1.0	Sweet corn	24	2.0
Galestown sand, 2 to 5 percent slopes.	1.0	Alfalfa	36	3.0
Klej loamy sand, 0 to 2 percent slopes.	1.0	Irish potatoes	24	2.0
Klej loamy sand, 2 to 5 percent slopes.	1.0	Sweetpotatoes	24	2.0
Lakeland loamy sand, clayey substratum, 0 to 2 percent slopes.	1.0	Tomatoes	27	2.3
Lakeland loamy sand, clayey substratum, 2 to 5 percent slopes.	1.0	Orchard with cover	36	
Lakeland loamy sand, clayey substratum, 5 to 10 percent slopes.	1.0	Orchard without cover	36	3.0
Lakeland sand, clayey substratum, 2 to 10 percent slopes.	1.0	Grass mixtures	24	2.0
	1.0	Soybeans	24	2.0
Group 2: Well-drained to somewhat excessively drained loamy sands to a depth of about 18 inches. The fine-textured subsoil is 8 to 12 inches thick and is underlain by sand.	.9	Truck group 1	18	1.5
Sassafras loamy sand, 0 to 2 percent slopes.	.9	Truck group 2	18	1.5
Sassafras loamy sand, 2 to 5 percent slopes.	.9	Truck group 3	18	1.5
Sassafras loamy sand, 2 to 5 percent slopes, moderately eroded.	.9	Corn	27	2.8
Sassafras loamy sand, 5 to 10 percent slopes.	1.0	Sweet corn	24	2.5
Sassafras loamy sand, 5 to 10 percent slopes, moderately eroded.	.9	Alfalfa	27	2.8
	.9	Irish potatoes	18	1.5
	.9	Sweetpotatoes	18	1.5
	1.0	Tomatoes	27	2.8
	.9	Orchard with cover	27	2.8
	1.0	Orchard without cover	27	2.8
	.9	Grass mixtures	24	2.5
		Soybeans	24	2.5

TABLE 12.—*Irrigation groups, suitable crops, and certain water relationships*—Continued

[Generally, only moderately well drained to somewhat excessively drained soils that are suited to regular cultivation are suitable for irrigation, but there are some exceptions]

Irrigation groups and soils	Estimated maximum rate of application on level and nearly level soils [1]	Suitable crops	Estimated average depth to be irrigated	Estimated average available moisture capacity [2]
	In. per hr.		*In.*	*In.*
Group 3: Moderately well drained and well drained sandy loams to a depth of about 10 inches. The subsoil is sandy clay loam to a depth of about 30 inches or more.	0. 6	Truck group 1	12	1. 7
	. 6	Truck group 2	15	2. 2
	. 6	Truck group 3	18	2. 7
Sassafras sandy loam, 0 to 2 percent slopes.	. 6	Corn	24	3. 7
Sassafras sandy loam, 2 to 5 percent slopes.	. 6	Sweet corn	18	2. 7
Sassafras sandy loam, 2 to 5 percent slopes, moderately eroded.	1. 0	Alfalfa	27	4. 2
Sassafras sandy loam, 5 to 10 percent slopes.	. 6	Irish potatoes	18	2. 7
Sassafras sandy loam, 5 to 10 percent slopes, moderately eroded.	. 6	Sweetpotatoes	18	2. 7
	. 6	Tomatoes	24	3. 7
Sassafras sandy loam, heavy substratum, 0 to 2 percent slopes.	1. 0	Orchard with cover	27	4. 2
Sassafras sandy loam, heavy substratum, 2 to 5 percent slopes.	. 6	Orchard without cover	27	4. 2
Woodstown sandy loam, 0 to 2 percent slopes.[3]	1. 0	Grass mixtures	18	2. 7
Woodstown sandy loam, 2 to 5 percent slopes.[3]	. 6	Soybeans	18	2. 7
Woodstown sandy loam, 2 to 5 percent slopes, moderately eroded.[3]				
Woodstown sandy loam, 5 to 10 percent slopes.				
Group 4: Moderately well drained and well drained loams and silt loams to a depth of about 10 inches. The subsoil is sandy clay loam or silty clay loam to a depth of about 30 inches or more.	. 4	Truck group 1	12	2. 0
	. 4	Truck group 2	15	2. 5
	. 4	Truck group 3	18	3. 0
Matapeake silt loam, 0 to 2 percent slopes.	. 4	Corn	24	4. 0
Matapeake silt loam, 2 to 5 percent slopes, moderately eroded.	. 4	Sweet corn	18	3. 0
Mattapex silt loam, 0 to 2 percent slopes.[3]	. 7	Alfalfa	27	4. 5
Mattapex silt loam, 2 to 5 percent slopes, moderately eroded.[3]	. 4	Irish potatoes	18	3. 0
Sassafras loam, 0 to 2 percent slopes.	. 4	Sweetpotatoes	18	3. 0
Sassafras loam, 2 to 5 percent slopes, moderately eroded.	. 4	Tomatoes	24	4. 0
Sassafras loam, heavy substratum, 0 to 2 percent slopes.	. 7	Orchard with cover	27	4. 5
Woodstown loam, 0 to 2 percent slopes.[3]	. 4	Orchard without cover	27	4. 5
Woodstown loam, 2 to 5 percent slopes, moderately eroded.[3]	. 7	Grass mixtures	18	3. 0
	. 4	Soybeans	18	3. 0

[1] The maximum rate for the application of water applies only if conditions are ideal and soils are level or nearly level. The rate must be adjusted to suit site conditions, such as slope, structure, degree of erosion, cropping systems, and the history of the area to be irrigated.

[2] The figures for available moisture capacity are estimates and are intended to be averages for all soils of the group. There are some variations between soils within a group, particularly between soils that differ in structure, in slope, and in the degree of erosion.

[3] These soils are only moderately well drained; artificial drainage is needed for most crops, except possibly grass mixtures, to make these soils suitable for irrigation.

Drainage groups

The soils of Caroline County that require artificial drainage have been grouped according to similarity in drainage requirements. All of the soils of a particular group have similar characteristics and about the same kind of drainage problems. Each group differs from the others mainly in the kind and intensity of the drainage problems and in the practices required for meeting these problems. Table 13 lists the soils in each of the drainage groups, describes the major factors that affect drainage, and indicates the best kind of drainage system to use. Information for this table was taken from the "Drainage Guide for Maryland." [9] By using this grouping in conjunction with the detailed soil map, it is possible for farmers and the drainage engineers to know where a particular kind of drainage system can be expected to function satisfactorily. However, a more extensive examination of the site should be made before any drainage system is installed. The cost of draining some soils is too high to be justified.

The texture, the permeability, and the degree of wetness of the soil, and the crop to be grown determine the spacing to be used when installing any type of drainage system. These characteristics and the texture of the substratum determine the depth of the ditches or the grade of the tile lines when a drainage system is installed. If ditches are used for drainage, the kind of soil, its depth, and the characteristics of the underlying soil material must be considered. It is difficult to maintain a stable ditchbank in areas where the soils are shallow over loose sand, because water will loosen the sand and cause it to clog the ditches.

[9] UNITED STATES DEPARTMENT OF AGRICULTURE. DRAINAGE GUIDE FOR MARYLAND. (In cooperation with Md. Agr. Col.) 1960. [Mimeographed]

In cultivated areas a network of small lateral ditches can be used to remove the excess water. From the lateral ditches, the water flows into a larger ditch and then into a natural drainageway. The number of lateral ditches needed depends on the kind of soil. The Woodstown soils, for example, require only a few widely spaced lateral ditches. The Elkton soils require laterals that are much closer together.

Many farmers "land" the soils, that is, they build a low bed between small lateral ditches. The surface of the bed slopes gradually from the middle toward each of the ditches. This is especially effective in areas of very wet soils, such as those of the Bayboro, Bibb, Elkton, Fallsington, Johnston, Othello, Plummer, Pocomoke and Portsmouth series.

The kind of soil and the slope determine the spacing of tile. In fine-textured, slowly permeable soils, such as those of the Elkton series, the tile lines must be laid closer together than in porous, sandy soils, such as those of the Klej series.

Sewage disposal groups

Caroline County is dominantly rural. Adequate sewerage systems have been installed in the towns, but in rural areas and in small communities beyond the existing sewerage lines it is necessary to use septic tanks for sewage disposal.

Some septic tanks that are installed in dry weather may function properly at first but fail to function after a heavy rainfall. Most of these failures occur in areas where the soils are poorly drained and where the subsoil is dense, compact, or fine textured. In wet weather, and for long periods afterwards, these soils are saturated; there is no space for outflow from septic tanks, and the movement of sewage effluent is very slow. Failures have occurred also where the soils are steep, shallow, or subject to flooding.

The suitability of the soils as fields for septic tanks is indicated in table 11, under the heading "Soil Properties and Engineering Interpretations." The ratings are applicable only where the slope is less than 5 percent. The soils for which ratings are given are arranged alphabetically in this table; hence, the ratings are not grouped or classified.

Various agencies in Maryland have cooperated to determine what soil characteristics should be considered before a septic tank is installed. They have arranged the soils in eight groups on a statewide basis, according to suitability as fields for septic tanks. The factors that limit and those that favor the functioning of a septic tank have been indicated in the description of each group. This grouping is a guide to sewage disposal by septic tanks through a subsurface-tile filter field. It does not apply to disposal of effluent by flow into a seepage pit, and it does not apply to systems in which pressure or other means is used to force sewage waste into the earth. No soils in Caroline County are in group 4, 5, or 6 of the statewide grouping.

By using this grouping, along with the detailed soil map, it is possible to locate areas where septic tanks can be expected to function satisfactorily. An intensive examination of the site, however, should be made before a septic tank is installed.

TABLE 13.—*Drainage groups, and suggested drainage systems*

[Not included in these groups are the soils that have good to excessive natural drainage, and the soils and land types for which drainage is not practical]

Drainage groups and soils	Major problems	Slope range	Kind of drainage system	Remarks
		Percent		
Group 2A: Moderately well drained loam and silt loam that have a moderately fine textured subsoil and a sandy substratum.	Brief seasonal high water table; impeded drainage in the lower part of the subsoil.	0 to 2	Tile in a random system; tile in a patterned system; open ditches.	Smoothing may be necessary.
(MsA) Mattapex silt loam, 0 to 2 percent slopes.		2 to 5	Tile in a random system; tile in a patterned system; diversions.	
(MsB2) Mattapex silt loam, 2 to 5 percent slopes, moderately eroded.				
(WdA) Woodstown loam, 0 to 2 percent slopes.				
(WdB2) Woodstown loam, 2 to 5 percent slopes, moderately eroded.				
Group 2B: Moderately well drained sandy loam that has a moderately fine textured subsoil and a sandy substratum.	Brief seasonal high water table; impeded drainage in the lower part of the subsoil.	0 to 2	Tile in a random system; tile in a patterned system; open ditches.	Smoothing may be necessary.
(WoA) Woodstown sandy loam, 0 to 2 percent slopes.		2 to 5	Tile in a random system; tile in a patterned system; diversions.	Boundary drainage may be practical on soils of this group.
(WoB) Woodstown sandy loam, 2 to 5 percent slopes.				
(WoB2) Woodstown sandy loam, 2 to 5 percent slopes, moderately eroded.				

TABLE 13.—*Drainage groups, and suggested drainage systems*—Continued

[Not included in these groups are the soils that have good to excessive natural drainage, and the soils and land types for which drainage is not practical]

Drainage groups and soils	Major problems	Slope range	Kind of drainage system	Remarks
		Percent		
Group 4: Deep, moderately well drained soils that have a loamy sand or sand subsoil. (KsA) Klej loamy sand, 0 to 2 percent slopes. (KsB) Klej loamy sand, 2 to 5 percent slopes.	Depressions that have a seasonal high water table for a long period.	0 to 2 2 to 5	Tile in a random system; interceptor ditches. Tile in a random system; diversions.	Interceptor tile may be used with diversions; overdrainage possible in dry seasons.
Group 7A: Poorly drained soil that has a sandy clay loam subsoil and a sandy substratum. (Fa) Fallsington loam.	Brief to long periods of high water table.	0 to 2	Field ditches	Use graded rows with ditches; use tile interceptors to collect upland seepage.
Group 7B: Poorly drained soil that has a sandy clay loam subsoil and a sandy substratum. (Fs) Fallsington sandy loam.	Brief to long periods of high water table.	0 to 2	Tile in a patterned system; field ditches.	Use graded rows with ditches; use tile interceptors to collect upland seepage.
Group 8–1A: Poorly drained, medium-textured soil that has a silty clay loam subsoil and a sandy substratum. (Oh) Othello silt loam.	Long periods of high water table.	0 to 2	Field ditches	Smoothing may be necessary.
Group 8–2B: Poorly drained, medium-textured soils that have a fine-textured very slowly permeable subsoil. (Ek) Elkton loam. (Em) Elkton silt loam.	Long periods of high water table.	0 to 2	Field ditches	Smoothing may be necessary.
Group 9–1: Poorly drained soil that has a loamy sand or sand subsoil. (Pm) Plummer loamy sand.	Long to very long periods of high to very high water table.	0 to 2	Tile in a patterned system; field ditches.	Overdrainage possible in dry seasons; some areas subject to temporary ponding.
Group 9–3A: Very poorly drained, medium-textured soil that has a sandy clay loam subsoil and a sandy substratum. (Po) Pocomoke loam.	Long to very long periods of high to very high water table.	0 to 2	Tile in a random system; field drains.	Bedding may be needed between open drains.
Group 9–3B: Very poorly drained soil that has a sandy clay loam subsoil and a sandy substratum. (Ps) Pocomoke sandy loam.	Long to very long periods of high to very high water table.	0 to 2	Tile in a random system; field drains.	Bedding may be needed between open drains.
Group 9–4A: Very poorly drained, medium-textured soil that has a silty clay loam subsoil and a sandy substratum. (Pt) Portsmouth silt loam.	Long to very long periods of high to very high water table.	0 to 2	V-type ditches; field drains; bedding.	Bedding may be needed between open drains.
Group 9–6B: Very poorly drained silt loam with very slowly permeable clay subsoil. (Ba) Bayboro silt loam.	Long to very long periods of high to very high water table.	0 to 2	V-type ditches; field drains.	Bedding advisable on high-row plantings between drains.
Group 9–7: Very poorly drained organic soils with a sandy substratum. (Mu) Muck.	Long to very long periods of high to very high water table.	0 to 2	Field drains	Control water level to prevent overdrainage; may require pumping in extremely wet seasons.
Group 11A: Poorly drained and very poorly drained, medium-textured soils on the flood plains. (Bm) Bibb silt loam. (Jo) Johnston loam.	Flooding, seepage from uplands, and long to very long periods of high to very high water table.	0 to 2	V-type ditches; field drains; interceptor tile.	Use tile interceptors to collect upland seepage.
Group 12: Miscellaneous and unclassified soils on the flood plains. (Mt) Mixed alluvial land.	Various problems because of variations in soil.	0 to 2	V-type ditches	

SEWAGE DISPOSAL GROUP 1

These deep, well-drained soils have slopes of no more than 5 percent. They are underlain by pervious, unconsolidated deposits. They are not subject to flooding. The soils are—

GaA Galestown loamy sand, 0 to 2 percent slopes.
GaB Galestown loamy sand, 2 to 5 percent slopes.
GsA Galestown sand, 0 to 2 percent slopes.
GsB Galestown sand, 2 to 5 percent slopes.
LaA Lakeland loamy sand, clayey substratum, 0 to 2 percent slopes.
LaB Lakeland loamy sand, clayey substratum, 2 to 5 percent slopes.
MkA Matapeake silt loam, 0 to 2 percent slopes.
MkB2 Matapeake silt loam, 2 to 5 percent slopes, moderately eroded.
SaA Sassafras loam, 0 to 2 percent slopes.
SaB2 Sassafras loam, 2 to 5 percent slopes, moderately eroded.
ShA Sassafras loam, heavy substratum, 0 to 2 percent slopes.
SmA Sassafras loamy sand, 0 to 2 percent slopes.
SmB Sassafras loamy sand, 2 to 5 percent slopes.
SmB2 Sassafras loamy sand, 2 to 5 percent slopes, moderately eroded.
SnA Sassafras sandy loam, 0 to 2 percent slopes.
SnB Sassafras sandy loam, 2 to 5 percent slopes.
SnB2 Sassafras sandy loam, 2 to 5 percent slopes, moderately eroded.
SnB3 Sassafras sandy loam, 2 to 5 percent slopes, severely eroded.
SsA Sassafras sandy loam, heavy substratum, 0 to 2 percent slopes.
SsB Sassafras sandy loam, heavy substratum, 2 to 5 percent slopes.

About 104,785 acres (51.1 percent of the county) is in this group. The soils are suitable for properly installed septic tanks. There is little or no danger of failure due to the characteristics of the soils, especially if individual tanks are used. Some difficulty may develop if installations are concentrated. This occurs occasionally in a residential development where the houses are close together.

SEWAGE DISPOSAL GROUP 2

The soils in this group have many of the same characteristics as the soils of group 1. Generally, their slope range is 5 to 15 percent, but a few acres of Lakeland sand, clayey substratum, 2 to 10 percent slopes, is included. The soils are—

GaC Galestown loamy sand, 5 to 10 percent slopes.
GaD Galestown loamy sand, 10 to 15 percent slopes.
GsC Galestown sand, 5 to 10 percent slopes.
GsD Galestown sand, 10 to 15 percent slopes.
LaC Lakeland loamy sand, clayey substratum, 5 to 10 percent slopes.
LcC Lakeland sand, clayey substratum, 2 to 10 percent slopes.
SmC Sassafras loamy sand, 5 to 10 percent slopes.
SmC2 Sassafras loamy sand, 5 to 10 percent slopes, moderately eroded.
SmC3 Sassafras loamy sand, 5 to 10 percent slopes, severely eroded.
SmD Sassafras loamy sand, 10 to 15 percent slopes.
SnC Sassafras sandy loam, 5 to 10 percent slopes.
SnC2 Sassafras sandy loam, 5 to 10 percent slopes, moderately eroded.
SnC3 Sassafras sandy loam, 5 to 10 percent slopes, severely eroded.
SnD Sassafras sandy loam, 10 to 15 percent slopes.
SnD2 Sassafras sandy loam, 10 to 15 percent slopes, moderately eroded.

About 3,721 acres (1.8 percent of the county) is in this group. The soils are of fair suitability for use as fields for septic tanks. Because of the stronger slopes, the danger of surface seepage and downslope pollution is greater than in the soils in group 1, and the cost of excavating and grading is higher.

SEWAGE DISPOSAL GROUP 3

The soils in this group have many of the same characteristics as the soils of groups 1 and 2, but they have slopes of 15 percent or more. The soils are—

GaE Galestown loamy sand, 15 to 30 percent slopes.
GaF Galestown loamy sand, 30 to 60 percent slopes.
GsE Galestown sand, 15 to 30 percent slopes.
MkE Matapeake silt loam, 15 to 30 percent slopes.
SmE Sassafras loamy sand, 15 to 30 percent slopes.
SnE Sassafras sandy loam, 15 to 30 percent slopes.
SnF Sassafras sandy loam, 30 to 60 percent slopes.

About 2,451 acres (1.2 percent of the county) is in this group. Because of steep slopes, these soils are generally poorly suited or very poorly suited to use as fields for septic tanks. If large areas are available for sewage disposal and if there are adequate safeguards against pollution, septic tanks might be successful. Generally, in selecting sites for septic tanks, these soils should be avoided.

SEWAGE DISPOSAL GROUP 7

The soils in this group are poorly drained to moderately well drained. Their slowly permeable to almost impermeable subsoil restricts the movement of water and causes the water table to be seasonally high. Generally, these soils are not subject to flooding. The soils are—

Ba Bayboro silt loam.
Ek Elkton loam.
Em Elkton silt loam.
Fa Fallsington loam.
Fs Fallsington sandy loam.
KsA Klej loamy sand, 0 to 2 percent slopes.
KsB Klej loamy sand, 2 to 5 percent slopes.
MsA Mattapex silt loam, 0 to 2 percent slopes.
MsB2 Mattapex silt loam, 2 to 5 percent slopes, moderately eroded.
MsE Mattapex silt loam, 15 to 30 percent slopes.
Oh Othello silt loam.
Pm Plummer loamy sand.
Po Pocomoke loam.
Ps Pocomoke sandy loam.
Pt Portsmouth silt loam.
WdA Woodstown loam, 0 to 2 percent slopes.
WdB2 Woodstown loam, 2 to 5 percent slopes, moderately eroded.
WoA Woodstown sandy loam, 0 to 2 percent slopes.
WoB Woodstown sandy loam, 2 to 5 percent slopes.
WoB2 Woodstown sandy loam, 2 to 5 percent slopes, moderately eroded.
WoC Woodstown sandy loam, 5 to 10 percent slopes.

About 82,633 acres (40.4 percent of the county) is in this group. The soils generally should not be used for septic tank fields. They are the soils in which most failures have occurred. The impeded drainage generally causes septic tanks located on these soils to fail if there is no special means of disposing of the effluent. Even if water can move through the soils when they are not saturated, there is no place for it to go if the water table is high.

SEWAGE DISPOSAL GROUP 8

These soils are subject to flooding from streams or by normal high tides. The soils are—

Bm Bibb silt loam.
Jo Johnston loam.
Mt Mixed alluvial land.
Mu Muck.
Sw Swamp.
Tm Tidal marsh.

About 10,925 acres (5 percent of the county) is in this group. These soils are unsuitable for use as fields for septic tanks.

Use of the soil survey in community planning

As a rule, the soils that are best for farming are also good for building sites. Therefore, an orderly plan for land use is desirable.

Under the heading "Sewage Disposal Groups," the soils are grouped according to their suitability as filter fields for septic tanks. The same grouping can serve in planning uses of the areas for other purposes.

Sewage disposal groups 1 and 2 include most of the soils that make the best farmland. Some of the soils in group 7 can be improved and used for agriculture if they are adequately drained. Some of the soils of group 8 are valuable for agriculture even though they are flooded occasionally.

In a suburban community and in some rural areas, land is needed for public recreational use. Within practical limits, acreages of the soils least valuable for farming should be reserved for parks and other public areas. The sloping to steep soils of sewage disposal group 3 are almost ideal for parks and other recreational uses. Many of these areas are now wooded. Some soils of group 7, particularly those that are in scattered small areas, can be used for community parks.

Parks should be kept forested, insofar as possible. Few areas need to be cleared, and many areas can be reforested. Forests increase the esthetic values of an area and help to retard excessive runoff, control erosion, and prevent flooding.

Revegetating or otherwise stabilizing cuts, fills, roadbanks, shoulders, and other areas where the soil material has been disturbed can be costly. In table 11, page 42, in the section "Engineering Uses of the Soils," the soils of the county are rated according to their suitability as a source of topsoil. Use of good topsoil helps in establishing protective vegetation in areas that have been disturbed.

Formation, Morphology, and Classification of the Soils

This section consists of two main parts. The first part discusses the factors of soil formation as they relate to the development of the soils in Caroline County. The second part discusses the great soil groups in the county, classifies the soil series according to great soil groups, and describes the characteristics of each group.

Factors of Soil Formation

Soils are the products of soil-forming processes acting upon material deposited or accumulated by geologic forces. The factors that contribute to the differences among soils are climate, plant and animal life, parent material, topography, and time. Climate and plant and animal life, particularly vegetation, are the active forces in soil formation. Their effect on the parent material is modified by topography and by the length of time the parent material has been in place. The relative importance of each factor differs from place to place. In extreme cases one factor may dominate in the formation of a soil and determine most of its properties, but normally the interaction of all five factors determines the kind of soil that develops in any given place. A brief discussion of these factors of soil formation is given in this section.

Climate

Caroline County has the rather humid, temperate climate that is typical of coastal areas of the Middle Atlantic States. The average temperature and the distribution of rainfall by months are indicated in table 1 (see p. 2). The climate is fairly uniform throughout the county. There are no significant differences in the elevation and no obstructions to the movement of winds, clouds, and rainstorms. Masses of air move through the county from a northerly or westerly direction, but they are modified by warm air that moves in periodically from the south and southwest.

This humid, temperate climate has caused most of the soils to be strongly weathered, leached, and acid and to be comparatively low in fertility. In most places, the soil material is weathered to a great depth, because it has been exposed to climatic forces for a fairly long period of geologic time. Materials not deeply weathered are highly resistant to weathering.

There are no free carbonates in the soils of the county, and a large part of the bases has been leached out. All of the soils are naturally acid, and most of them are strongly acid to extremely acid. Most of the soils are low in plant nutrients, although some have a moderate supply.

Plant and animal life

Before settlement of the county, the native vegetation played a major part in the development of soils in Caroline County. The activities of micro-organisms, earthworms, larvae, and other forms of animal life were essential to the cycle of decay and regeneration of vegetation.

The first settlers found a dense forest that consisted mainly of hardwoods. Oak was the dominant species in most parts of the county. Loblolly pine, pond pine, Virginia pine, shortleaf pine, yellow-poplar, holly, gum, hickory, maple, and dogwood were also important. There were few pure stands of pine before the county was settled. The fairly pure stands of pine that exist today, particularly of loblolly pine, are generally in areas that were once cleared and cultivated.

Most hardwood trees take up large amounts of calcium and other bases available in the soils. Soils that are normally high in bases remain so under a cover of deciduous trees, because a large proportion of the bases is returned to the soil each year when the leaves fall. The bases reenter the soil when the leaves decompose, and they are again used by plants. Thus, there is a never-ending cycle where the soils are high in bases. However, the soils in Caroline County were never high in bases; consequently, they are acid, even under a hardwood forest. Soils that are strongly acid and low in fertility are better suited to pine than to most hardwoods. Pine does not require a large amount of calcium and other bases, and the needles do little to restore fertility to the soil.

As agriculture has developed in the county, man has become an important factor in the development of the soils. Clearing, cultivation, the introduction of new

plants, and artificial drainage will affect future soil development.

The complex of living organisms affecting soil formation in Caroline County has been drastically changed as a result of man's activity. Other important changes brought about by man are the mixing of the upper horizons of the soils to form a plow layer, the loss of soil on sloping fields, and changes in content of plant nutrients, especially in the upper horizons, as a result of liming and fertilizing. The most obvious change in the vegetation has been the loss of the natural vegetation, primarily because of the clearing of the forest to make way for farms, towns, and highways. In the forests that remain, there has been a notable increase in the proportion of pine.

Parent material

Most of the soils in Caroline County formed from sediments transported by water, but some of the sediments were transported by wind and some by ice floes carried by glacial melt water. The texture of the deposits varies from coarse gravel to fine clay.

The stones and larger pebbles must have been transported by ice during the retreat of the last glaciers. The Eastern Shore of Maryland was not glaciated, but glaciers once extended as far south as the northern part of Pennsylvania. Fragments of ice containing clay, gravel, and a few stones may have descended into the area that is now the Eastern Shore through the valley of the Susquehanna and other rivers. As the ice floes drifted southward, they melted and dropped sediments into the shallow seas. The areas in which sediments were dropped were later uplifted to form the Delmarva Peninsula, of which Caroline County is a part.

The soil material in marshes and other low-lying areas consists of sediments that were recently deposited in shallow salt water. These sediments were elevated to sea level by the slow uplift of the land or by fluctuations in the level of the sea and of the Chesapeake Bay.

The texture of a soil is directly related to the texture of its parent material. Galestown, Lakeland, Klej, and Plummer soils developed in coarse-textured material. There is some evidence that the material from which the Galestown and Lakeland soils developed was reworked by wind or by water, or by both. Both Lakeland and Galestown soils occur in part on old alluvial terraces along the major streams.

Large areas are occupied by soils that formed from sediments consisting of a mixture of sand and silt and a small, but variable, amount of clay. In places this material is stratified and the texture varies in alternating layers. Fallsington, Pocomoke, Sassafras, and Woodstown soils formed in this material.

Matapeake, Mattapex, Othello, and Portsmouth soils developed in a silty mantle over sand. The silty material is probably loess blown from glaciated areas to the north.

Bayboro and Elkton soils developed from fine-textured sediments of clay and silty clay that contained some fine sand and very fine sand.

There are also several kinds of recently deposited sediments in the county. Bibb and Johnston soils formed in recent deposits of alluvium on flood plains. Muck consists of decomposed organic material.

More than one kind of soil may develop from the same kind of parent material or from similar parent material. This is because factors other than parent material have also influenced the kinds of soils that have developed.

Topography

Caroline County is entirely within the Atlantic Coastal Plain. Most of it is level or gently sloping. Generally, the slopes are less than 5 percent but there are small, but important, areas that have slopes of 5 to 10 percent. Most of these areas are smooth, but some are complex or hummocky. A few areas have slopes of 10 to 30 percent or more. These areas occupy less than 2 percent of the county and occur on breaks above drainageways.

Most of the county slopes toward the south, but a part of it slopes toward the west. In only a few places are there differences in elevation of as much as 20 feet in 1 mile. The highest elevations are in the northern and northeastern parts of the county. The highest point, 75 feet above sea level, is about 1 mile southwest of Templeville. The lowest point, about 5 feet above sea level, is along the lower part of the Choptank River.

The mild relief of the county contributes to the slow drainage of many of the soils. Water flows very slowly into the main channels, especially from areas that are nearly level. It also moves slowly through many of the soils.

Time

The soils of Caroline County range in age from very young, or immature, to fairly old. A mature soil is one that has well-defined, genetically related horizons; an immature soil is one that shows little or no horizonation. The parent material of a mature soil may not be so old, however, as that of an immature soil. The most recent parent materials are Holocene deposits on alluvial flood plains. In these areas soil material is added from year to year by floods. Somewhat older, geologically, are the sands, somewhat gravelly sands, and silts over sands, which are probably of Pleistocene age. Most of the older Coastal Plain deposits are probably of Miocene age, but some may be of Pliocene age.[10]

The effect of time is modified by topography and other factors. For example, on stronger slopes no well-defined horizons have developed, because the soil material has been removed by geologic erosion almost as rapidly as it has formed. On the other hand, some soils formed in material deposited fairly recently have well-defined and presumably mature profiles. These soils are in nearly level areas, where there has been no geologic erosion, and the products of the soil-forming processes have remained in place as components of genetic soils.

Morphology of the Soils

Most of the soils of Caroline County have evident horizonation. The exceptions are some of the alluvial soils and some soils on dunelike formations that developed from almost pure quartz sand.

[10] RYAN, J. DONALD. THE SEDIMENTS OF CHESAPEAKE BAY. State of Maryland, Dept. of Geology, Mines and Water Resources, Bul. No. 12, 120 pp. 1953.

The differentiation of horizons in the soils of the county is the result of several soil-forming processes. The most important of these are the following: (1) Accumulation of organic matter, (2) leaching of carbonates and salts more soluble than calcium carbonate, (3) chemical weathering, chiefly by hydrolysis, of the primary minerals of the parent material into silicate clay minerals, (4) translocation of the silicate clay minerals, and probably of some silt-sized particles, from one horizon to another, and (5) chemical changes (oxidation, reduction, and hydration) and transfer of iron.

These processes have taken place in most of the soils in this county. The degree of activity or strength of each process, however, varies from soil to soil. For example, the interaction of the first, second, third and fourth processes is reflected in the strong horizons of Sassafras soils. All five processes have been active in the development of Woodstown and Mattapex soils. Only the first and fifth of these processes have had any marked effect on Bibb, Johnston, and Plummer soils. In most soils, however, the parent material must have been affected by the second process, leaching of carbonates and salts, and possibly by some of the other processes as well.

In all of the soils, some organic matter has accumulated to form an A1 horizon. The A1 horizon may have lost its identity as a result of plowing and cultivation, becoming mixed with underlying horizons to form an Ap horizon. The quantity of organic matter accumulated varies from very low to very high. Galestown and Lakeland soils have a weak A1 horizon that contains very little organic matter, but Bayboro, Johnston, Pocomoke, and Portsmouth soils have a prominent A1 horizon that is as much as 15 percent organic matter.

There have been no detailed studies of the clay mineralogy of the soils of the Eastern Shore of Maryland. The soil material in this area consists of sediments from many parts of the Atlantic watershed. These sediments were transported by the Susquehanna and Potomac Rivers, and possibly by the Delaware River. It is likely that the clay minerals in the soils are varied in composition as well as in origin. Kaolinite is one of the main clay minerals in mature soils, such as Sassafras soils.

The translocation of silicate clay minerals has had a strong influence on the development of horizons in many of the soils of the county. Clay has been removed in part from the A1 and A2 horizons and has become immobilized, or nearly so, in the B horizon. This is true of all soils that have a textural B horizon, such as Bayboro, Elkton, Fallsington, Matapeake, Mattapex, Othello, Pocomoke, Portsmouth, Sassafras, and Woodstown soils. It is probably true of some soils that do not have a distinct textural B horizon, such as Galestown and Klej soils.

The reduction and transfer of iron has occurred to some degree in all soils that have impeded drainage. In the many naturally wet soils of Caroline County, this process, which is known as gleying, has been of very great importance. It has particularly affected Bayboro, Bibb, Elkton, Fallsington, Johnston, Othello, Pocomoke, and Portsmouth soils. Klej, Mattapex, Plummer, and Woodstown soils have been affected to a lesser degree.

Iron that is reduced under conditions of poor aeration usually become mobile. It may be removed from the soils entirely, but in the soils of Caroline County it has commonly been moved only a short distance and may have stopped either in the horizon where it originated or in another nearby horizon. Part of this iron may be reoxidized and segregated to form the yellowish-brown, strong-brown, or yellowish-red mottles common in the gleyed horizons of all soils that have impeded drainage. In some areas it may form concretions that consist primarily of reoxidized iron.

In the formation of silicate clays from primary minerals, some iron is usually freed as a hydrated oxide. Depending on the degree of hydration, these oxides are more or less red. A small amount of these oxides is sufficient to color a soil, particularly if silicate clay minerals are not abundant and if the parent material is fairly coarse textured. A "color B" horizon may be formed, even if there has not been enough accumulation of clay minerals to form a textural B horizon. This is characteristic of Galestown soils in this county.

Profiles representative of each soil series in the county are described in the section "Descriptions of the Soils," and the morphology of the representative soils is described in detail.

Classification of the Soils by Great Soil Groups

The soil classification system used in the United States consists of six categories.[11] Beginning with the most inclusive, these categories are the order, the suborder, the great soil group, the family, the series, and the type.

There are three orders and thousands of types. The suborder and family categories have never been fully developed and consequently have been little used. Attention has been concentrated on the classification of soils into types and series within counties or comparable areas and on the subsequent grouping of series into great soil groups and orders. Soils that are alike in fundamental characteristics are classified as one great soil group.

The great soil groups recognized in Caroline County are Sols Bruns Acides, Gray-Brown Podzolic soils, Humic Gley soils, Low-Humic Gley soils, Bog soils, and Regosols. Many of the soils of the county do not fit the modal, or central, concept of any one great soil group. These soils, called intergrades, have mainly the characteristics of a given great soil group, but they also have one or more characteristics of another group. The great soil groups are described in the following pages.

Sols Bruns Acides

In Caroline County, Sols Bruns Acides have an evident A1 horizon, about 2 to 4 inches thick, and a very weak A2 horizon or none at all. The B horizon is differentiated almost entirely by color. It is redder and higher in chroma than either the A or the C horizon. It has little structural development or differentiation. Its clay content is only slightly greater than that of the horizons above and below. These soils have a low degree of base saturation and are usually very strongly acid.

Sols Bruns Acides are represented in this county by the Galestown soils.

[11] UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL CLASSIFICATION. SOILS AND MEN, U.S. Dept. Agr. Ybk., pp. 979–1001. 1938.

Gray-Brown Podzolic soils

Gray-Brown Podzolic soils are typical of forested, temperate, humid regions. In the natural state, a true Gray-Brown Podzolic soil has a fairly thin layer of leaf litter and a rather thin humus layer over a dark-colored mineral surface soil. There is a grayish-brown leached subsurface horizon over a moderately heavy, blocky, or subangular blocky B horizon. The B horizon is brown, brownish yellow, yellowish brown, or reddish brown. The solum is moderately thick to thick, and the reaction is most commonly slightly acid but ranges from medium acid to neutral.

There are no modal Gray-Brown Podzolic soils in Caroline County. Matapeake, Mattapex, Sassafras, and Woodstown soils are classified as Gray-Brown Podzolic soils but have some characteristics of Red-Yellow Podzolic soils. The A horizon is more strongly bleached, and the B horizon is more red or yellow and less brown. These intergrades are more strongly acid throughout than the modal Gray-Brown Podzolic soils.

Humic Gley soils

Humic Gley soils are very poorly drained hydromorphic soils. They have a thick, prominent A horizon that is high in organic matter. In some areas their B horizon is strongly reduced or mottled, but in other areas they lack a B horizon and have only a substratum. The mottling or gleying may extend upward into the lower part of the A horizon.

Humic Gley soils usually occur under a wet-forest or marsh type of vegetation in a humid or subhumid climate. They range from extremely acid to mildly alkaline in reaction. Those in Caroline County are very strongly acid or extremely acid.

Bayboro, Johnston, Pocomoke, and Portsmouth soils are in the Humic Gley great soil group. They are very poorly drained and are wet much of the year. They have a high water table, and the Bayboro and Portsmouth soils have a slowly permeable subsoil.

Low-Humic Gley soils

This great soil group is characterized by poorly drained soils that have a thin surface horizon that is moderately high in organic matter and a mottled or partially gleyed mineral subsoil. Most Low-Humic Gley soils have some textural differentiation between horizons. The A horizon of a Low-Humic Gley soil is thinner and less prominent than that of a true Humic Gley soil, and it contains less organic matter. The B horizon is less strongly gleyed.

Bibb, Elkton, Fallsington, Othello, and Plummer soils fit the central concept of Low-Humic Gley soils. These soils are very strongly acid or extremely acid, and they are wet much of the year.

Bog soils

Bog soils are poorly drained soils consisting of, or developed from, accumulations of plant remains. They contain some sand, silt, and clay inorganic particles but are mostly organic matter. Bog soils develop in a humid climate from the vegetation of swamps, bogs, or marshes. They are extremely acid to moderately alkaline in reaction. The depth to the underlying mineral material ranges from 20 inches to many feet.

Muck is the only member of the Bog great soil group in Caroline County. It is composed of the decayed remains of swamp forest vegetation. Muck is extremely acid. It is underlain by acid sands.

Regosols

Regosols consist of deposits of relatively unweathered but soft rock or mineral material. They are poorly drained to excessively drained and show practically no evidence of genetic soil development, except for a very weakly developed A1 horizon. The parent material is either too young to have had time for soil horizons to develop, or is too resistant to weathering to show any appreciable effects of the processes of soil development, regardless of time. The first instance might be represented by fresh deposits of volcanic ash, and the second by dune deposits consisting of pure quartz sand.

Caroline County has two soil series that fit the general definition of a Regosol. These are Lakeland and Klej soils. They consist largely of quartz sand. The surface layer has been slightly darkened by a small accumulation of organic matter. There is no B horizon.

Weathering has had little effect on these soils. Klej soils are very weakly gleyed in the lower part of the parent material, but not enough so that they are considered intergrades toward any other great soil group.

Glossary

Alluvium. Fine material, such as sand, silt, or clay, that has been deposited on land by streams.

Available moisture capacity. The difference between the amount of water in a soil at field capacity and the amount in the same soil at the permanent wilting point. Commonly expressed as inches of water per inch depth of soil.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose. Noncoherent; will not hold together in a mass.

Friable. When moist, crushes easily under gentle to moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Firm. When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic. When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a wire when rolled between thumb and forefinger.

Sticky. When wet, adheres to other material; tends to stretch somewhat and pull apart, rather than pull free from other material.

Hard. When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft. When dry, breaks into powder or individual grains under very slight pressure.

Cemented. Hard and brittle; little affected by moistening.

Contour farming. Plowing, planting, cultivating, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grades.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.

Diversion. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course, and thus to protect areas downslope from the effects of such runoff.

Erosion. The wearing away of the land surface by wind, running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide nutrients, in adequate amounts and in proper balance, for the growth of specified plants, when other factors, such as light, moisture, temperature, and the physical condition (or tilth) of the soil, are favorable.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gleization. The reduction, translocation, and segregation of soil compounds, notably of iron, usually in the subsoil or substratum, as a result of poor drainage and aeration; expressed in the soil by mottled colors dominated by gray. The soil-forming processes leading to the development of a gley soil.

Gley soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Gravel. A mass of rounded or angular rock fragments ¼ inch to 3 inches in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. The relative position of the several soil horizons in a typical soil profile, and their nomenclature, are as follows:

A horizon. The surface horizon of a mineral soil, having maximum biological activity, or eluviation (removal of materials dissolved or suspended in water), or both.

B horizon. A soil horizon, usually beneath an A horizon, or surface soil, in which (1) clay, iron, or aluminum, with accessory organic matter, have accumulated; or (2) the structure is blocky or prismatic; or (3) the soil has some combination of these features. In soils that have distinct profiles, the B horizon is roughly equivalent to the general term "subsoil."

C horizon. The unconsolidated rock material in the lower part of the soil profile, like that from which the upper horizons (or at least a part of the B horizon) have developed.

D horizon. Any stratum underlying the C horizon, or the B horizon if no C is present, which is unlike the C or unlike the material from which the solum has formed. The Dr horizon, however, is a consolidated stratum, underlying the C, from which the C horizon has formed.

Internal soil drainage. The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by the height of the water table, either permanent or perched. Relative terms for expressing internal drainage are *none, very slow, slow, medium, rapid,* and *very rapid.*

Leaching. The removal of soluble material from soils or other material by percolating water.

Marine deposit. Material deposited in the waters of oceans and seas, and exposed by the elevation of the land or the lowering of the water level.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually results from poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* contrast—*faint, distinct,* and *prominent.*

Natural drainage. The conditions of drainage that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. The following terms are used to express natural drainage: *Excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained.*

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Included are nitrogen, phosphorus, calcium, magnesium, potassium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, oxygen, and hydrogen, obtained largely from the air and the water.

Parent material. The weathered rock or partly weathered soil material from which a soil has formed; the C horizon.

Permeability, soil. The quality of a soil that enables water or air to move through it. Terms used to describe permeability are *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material. See Horizon, soil.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values or in words as follows:

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher.

Relief. Elevations or inequalities of the land surface, considered collectively.

Sand. As a soil separate, individual rock or mineral fragments 0.05 to 2.0 millimeters in diameter. As a soil textural class, soil that is 85 percent or more sand and not more than 10 percent clay.

Silt. As a soil separate, individual mineral particles 0.002 to 0.05 millimeter in diameter. As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in a mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying parent material. Living roots and other plant and animal life are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. Structure is classified by grade, class, and type.

Grade. Distinctness of aggregation. It expresses the differential between cohesion within aggregates and adhesion between aggregates. Terms: *structureless (single grain or massive), weak, moderate,* and *strong.*

Class. Size of aggregates. Terms: *very fine* or *very thin, fine* or *thin, medium, coarse* or *thick,* and *very coarse* or *very thick.*

Type. Shape and arrangement of individual natural soil aggregates. Terms: *platy, prismatic, columnar, blocky, subangular blocky, granular,* and *crumb.* (Example of soil-structure grade, class, and type: Moderate, coarse, subangular blocky.)

Subsoil. Technically, the B horizon of a soil with a distinct profile; commonly, that part of the profile below plow depth.

Substratum. Any layer lying beneath the solum, or true soil; the C or D horizon.

Surface runoff. The amount of water removed by flow over the surface of the soil. The amount and rapidity of surface runoff are affected by the texture, structure, and porosity of the surface layer; by the vegetative covering, by the prevailing climate, and by the slope. The rate of surface runoff is expressed as follows: *very rapid, rapid, medium, slow, very slow,* and *ponded.*

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness; the plowed layer.

Texture, soil. The relative proportions of individual soil grains of the various size groups in a mass of soil; specifically, the proportions of sand, silt, and clay. (See Sand, Silt, and Clay.)

Tilth, soil. The physical properties of the soil that affect the ease with which it can be cultivated or that affect its suitability for crops; implies the presence or absence of favorable soil structure.

Topsoil. Presumably fertile soil or soil material, rich in organic matter, that is used to topdress roadbanks, parks, gardens, and lawns.

Upland (geologic). Land consisting of material unworked by water in recent geologic time and ordinarily lying at a higher elevation than flood plains and stream terraces.

Water table. The upper limit of the part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MARYLAND AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
CAROLINE COUNTY, MARYLAND

SOIL ASSOCIATIONS

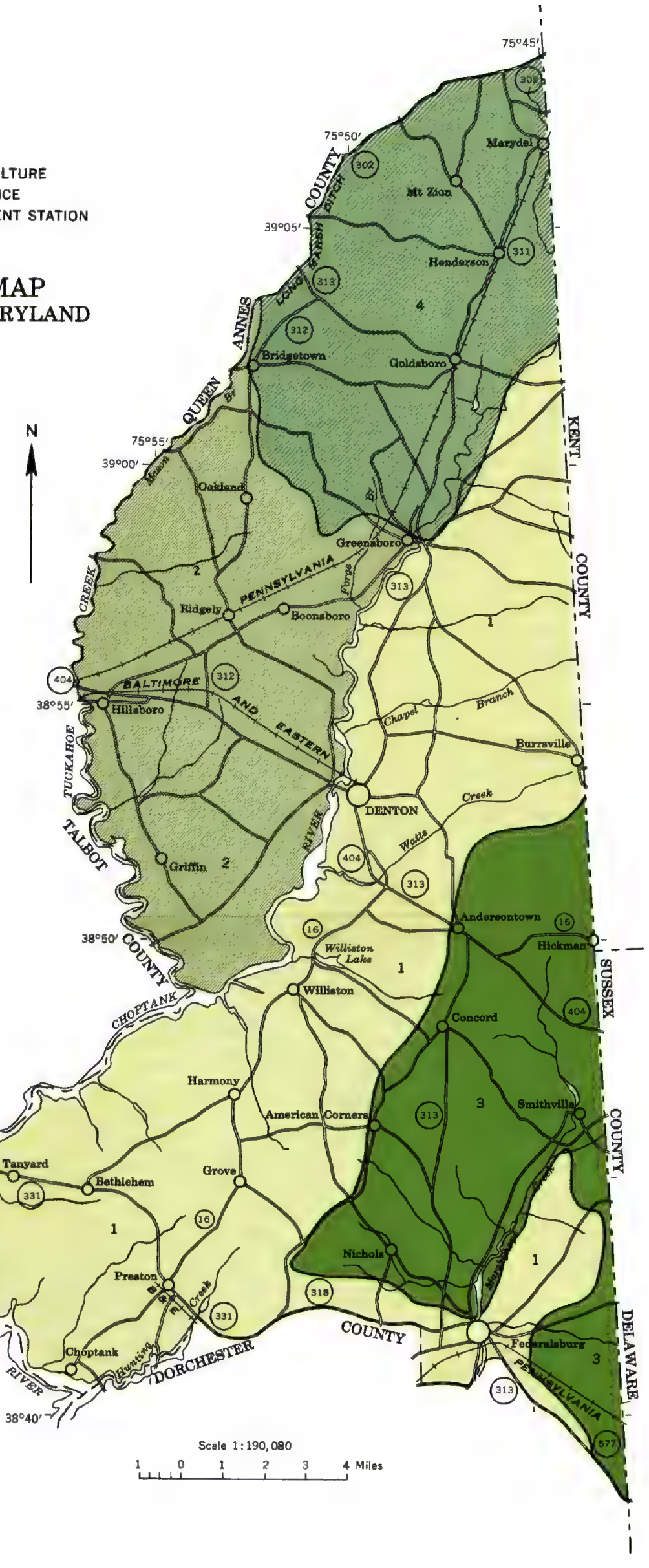
1 — Sassafras-Galestown-Fallsington association: Moderately coarse textured and coarse textured soils that are mostly well drained to excessively drained

2 — Sassafras-Fallsington-Woodstown association: Mostly moderately coarse textured soils that are well drained to poorly drained

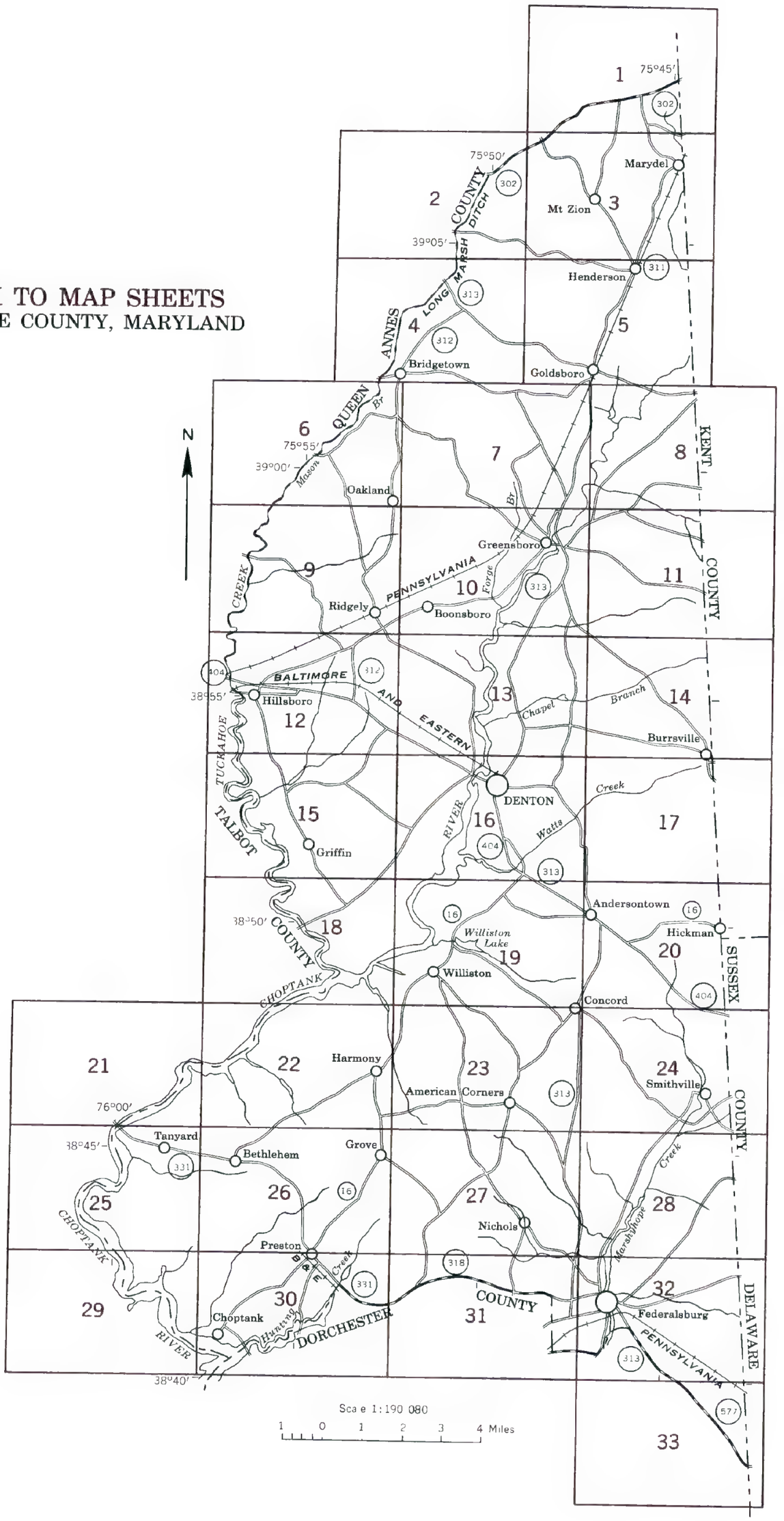
3 — Fallsington-Woodstown-Sassafras association: Mostly poorly drained soils

4 — Pocomoke-Fallsington association: Poorly drained and very poorly drained soils

May 1962



INDEX TO MAP SHEETS
CAROLINE COUNTY, MARYLAND



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

CAROLINE COUNTY, MARYLAND

MARYLAND AGRICULTURAL EXPERIMENT STATION

SOIL LEGEND

The first capital letter in each symbol is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are for nearly level soils or land types, but some are for soils or land types that have a considerable range of slope. A final number, 2 or 3, in the symbol, shows that the soil is eroded or severely eroded.

SYMBOL	NAME
Ba	Bayboro silt loam
Bm	Bibb silt loam
Ek	Elkton loam
Em	Elkton silt loam
Fa	Fallsington loam
Fs	Fallsington sandy loam
GsA	Galestown loamy sand, 0 to 2 percent slopes
GsB	Galestown loamy sand, 2 to 5 percent slopes
GsC	Galestown loamy sand, 5 to 10 percent slopes
GsD	Galestown loamy sand, 10 to 15 percent slopes
GsE	Galestown loamy sand, 15 to 30 percent slopes
GsF	Galestown loamy sand, 30 to 60 percent slopes
GsA	Galestown sand, 0 to 2 percent slopes
GsB	Galestown sand, 2 to 5 percent slopes
GsC	Galestown sand, 5 to 10 percent slopes
GsD	Galestown sand, 10 to 15 percent slopes
GsE	Galestown sand, 15 to 30 percent slopes
Jo	Johnston loam
KsA	Klej loamy sand, 0 to 2 percent slopes
KsB	Klej loamy sand, 2 to 5 percent slopes
LaA	Lakeland loamy sand, clayey substratum, 0 to 2 percent slopes
LaB	Lakeland loamy sand, clayey substratum, 2 to 5 percent slopes
LaC	Lakeland loamy sand, clayey substratum, 5 to 10 percent slopes
LcC	Lakeland sand, clayey substratum, 2 to 10 percent slopes
Ma	Made land
MkA	Matapeake silt loam, 0 to 2 percent slopes
MkB2	Matapeake silt loam, 2 to 5 percent slopes, moderately eroded
MkE	Matapeake silt loam, 15 to 30 percent slopes
MsA	Mattapex silt loam, 0 to 2 percent slopes
MsB2	Mattapex silt loam, 2 to 5 percent slopes, moderately eroded
MsE	Mattapex silt loam, 15 to 30 percent slopes
Mt	Mixed alluvial land
Mu	Muck
Oh	Othello silt loam
Pm	Plummer loamy sand
Po	Pocomoke loam
Ps	Pocomoke sandy loam
Pt	Portsmouth silt loam
SaA	Sassafras loam, 0 to 2 percent slopes
SaB2	Sassafras loam, 2 to 5 percent slopes, moderately eroded
ShA	Sassafras loam, heavy substratum, 0 to 2 percent slopes
SmA	Sassafras loamy sand, 0 to 2 percent slopes
SmB	Sassafras loamy sand, 2 to 5 percent slopes
SmB2	Sassafras loamy sand, 2 to 5 percent slopes, moderately eroded
SmC	Sassafras loamy sand, 5 to 10 percent slopes
SmC2	Sassafras loamy sand, 5 to 10 percent slopes, moderately eroded
SmC3	Sassafras loamy sand, 5 to 10 percent slopes, severely eroded
SmD	Sassafras loamy sand, 10 to 15 percent slopes
SmE	Sassafras loamy sand, 15 to 30 percent slopes
SnA	Sassafras sandy loam, 0 to 2 percent slopes
SnB	Sassafras sandy loam, 2 to 5 percent slopes
SnB2	Sassafras sandy loam, 2 to 5 percent slopes, moderately eroded
SnB3	Sassafras sandy loam, 2 to 5 percent slopes, severely eroded
SnC	Sassafras sandy loam, 5 to 10 percent slopes
SnC2	Sassafras sandy loam, 5 to 10 percent slopes, moderately eroded
SnC3	Sassafras sandy loam, 5 to 10 percent slopes, severely eroded
SnD	Sassafras sandy loam, 10 to 15 percent slopes
SnD2	Sassafras sandy loam, 10 to 15 percent slopes, moderately eroded
SnE	Sassafras sandy loam, 15 to 30 percent slopes
SnF	Sassafras sandy loam, 30 to 60 percent slopes
SsA	Sassafras sandy loam, heavy substratum, 0 to 2 percent slopes
SsB	Sassafras sandy loam, heavy substratum, 2 to 5 percent slopes
Sw	Swamp
Tm	Tidal marsh
WdA	Woodstown loam, 0 to 2 percent slopes
WdB2	Woodstown loam, 2 to 5 percent slopes, moderately eroded
WoA	Woodstown sandy loam, 0 to 2 percent slopes
WoB	Woodstown sandy loam, 2 to 5 percent slopes
WoB2	Woodstown sandy loam, 2 to 5 percent slopes, moderately eroded
WoC	Woodstown sandy loam, 5 to 10 percent slopes

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail, foot
- Railroad
- Ferries
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings
- School
- Church
- Station

Mines and Quarries

Mine dump

Pits, gravel or other

Power lines

Pipe lines

Cemeteries

Dams

Levees

Tanks

Oil wells

BOUNDARIES

- National or state
- County
- Township, U. S.
- Section line, corner
- Reservation
- Land grant

DRAINAGE

Streams
- Perennial
- Intermittent, unclass.

Canals and ditches (CANAL, DITCH)

Lakes and ponds
- Perennial
- Intermittent

Wells (flowing)

Springs

Marsh

Wet spot

RELIEF

Escarpments
- Bedrock
- Other

Prominent peaks

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gullies
- Wind erosion, moderate

Soil map constructed 1963 by Cartographic Division, Soil Conservation Service, USDA, from 1958 aerial photographs. Controlled mosaic based on Maryland plane coordinate system, Lambert conformal conic projection, 1927 North American datum.

GUIDE TO MAPPING UNITS

[See table 3, p. 7, for approximate acreage and proportionate extent of soils; table 6, p. 27, for estimated average acre yields. To learn about the use of the soils for woodland, see the section beginning on p. 28; for information about engineering uses of the soils, including use for drainage, irrigation, and sewage disposal, see the section beginning on p. 33. Dashes under "Drainage group" indicate soil does not need drainage. Dashes under "Sewage disposal group," "Irrigation group," and "Woodland suitability group" indicate soil is not suitable for sewage disposal, irrigation, or woodland]

Map symbol	Mapping unit	Page	Capability unit		Drainage group		Sewage disposal group		Irrigation group		Woodland suitability group	
			Symbol	Page	Symbol	Page	Number	Page	Number	Page	Number	Page
Ba	Bayboro silt loam	8	IIIw–9	24	9–6B	47	7	48			6	31
Bm	Bibb silt loam	9	IIIw–7	24	11A	47	8	48			4	30
Ek	Elkton loam	9	IIIw–9	24	8–2B	47	7	48			6	31
Em	Elkton silt loam	9	IIIw–9	24	8–2B	47	7	48			6	31
Fa	Fallsington loam	10	IIIw–7	24	7A	47	7	48			3	30
Fs	Fallsington sandy loam	10	IIIw–6	24	7B	47	7	48			3	30
GaA	Galestown loamy sand, 0 to 2 percent slopes.	10	IIIs–1	24			1	48	1	44	2	30
GaB	Galestown loamy sand, 2 to 5 percent slopes.	11	IIIs–1	24			1	48	1	44	2	30
GaC	Galestown loamy sand, 5 to 10 percent slopes.	11	IVs–1	25			2	48	1	44	2	30
GaD	Galestown loamy sand, 10 to 15 percent slopes.	11	VIs–1	25			2	48			2	30
GaE	Galestown loamy sand, 15 to 30 percent slopes.	11	VIIs–1	25			3	48			2	30
GaF	Galestown loamy sand, 30 to 60 percent slopes.	11	VIIs–1	25			3	48			2	30
GsA	Galestown sand, 0 to 2 percent slopes.	11	IVs–1	25			1	48	1	44	5	30
GsB	Galestown sand, 2 to 5 percent slopes.	11	IVs–1	25			1	48	1	44	5	30
GsC	Galestown sand, 5 to 10 percent slopes.	11	VIs–1	25			2	48			5	30
GsD	Galestown sand, 10 to 15 percent slopes.	11	VIIs–1	25			2	48			5	30
GsE	Galestown sand, 15 to 30 percent slopes.	11	VIIs–1	25			3	48			5	30
Jo	Johnston loam	11	IIIw–7	24	11A	47	8	48			4	30
KsA	Klej loamy sand, 0 to 2 percent slopes.	12	IIIw–10	24	4	47	7	48	1	44	3	30
KsB	Klej loamy sand, 2 to 5 percent slopes.	12	IIIw–10	24	4	47	7	48	1	44	3	30
LaA	Lakeland loamy sand, clayey substratum, 0 to 2 percent slopes.	13	IIIs–1	24			1	48	1	44	2	30
LaB	Lakeland loamy sand, clayey substratum, 2 to 5 percent slopes.	13	IIIs–1	24			1	48	1	44	2	30
LaC	Lakeland loamy sand, clayey substratum, 5 to 10 percent slopes.	13	IVs–1	25			2	48	1	44	2	30
LcC	Lakeland sand, clayey substratum, 2 to 10 percent slopes.	13	IVs–1	25			2	48	1	44	5	30
Ma	Made land	13										
MkA	Matapeake silt loam, 0 to 2 percent slopes.	13	I–4	23			1	48	4	44	1	28
MkB2	Matapeake silt loam, 2 to 5 percent slopes, moderately eroded.	13	IIe–4	23			1	48	4	44	1	28
MkE	Matapeake silt loam, 15 to 30 percent slopes.	13	VIe–2	25			3	48			1	28
MsA	Mattapex silt loam, 0 to 2 percent slopes.	14	IIw–1	23	2A	46	7	48	4	44	1	28
MsB2	Mattapex silt loam, 2 to 5 percent slopes, moderately eroded.	14	IIe–16	23	2A	46	7	48	4	44	1	28
MsE	Mattapex silt loam, 15 to 30 percent slopes.	14	VIe–2	25			7	48			1	28
Mt	Mixed alluvial land	14	VIw–1	25	12	47	8	48			4	30
Mu	Muck	15	VIIw–1	25	9–7	47	8	48				
Oh	Othello silt loam	15	IIIw–7	24	8–1A	47	7	48			3	30
Pm	Plummer loamy sand	15	IVw–6	25	9–1	47	7	48			3	30
Po	Pocomoke loam	16	IIIw–7	24	9–3A	47	7	48			3	30
Ps	Pocomoke sandy loam	16	IIIw–6	24	9–3B	47	7	48			3	30
Pt	Portsmouth silt loam	16	IIIw–7	24	9–4A	47	7	48			3	30
SaA	Sassafras loam, 0 to 2 percent slopes.	18	I–4	23			1	48	4	44	1	28
SaB2	Sassafras loam, 2 to 5 percent slopes, moderately eroded.	18	IIe–4	23			1	48	4	44	1	28
ShA	Sassafras loam, heavy substratum, 0 to 2 percent slopes.	18	I–4	23			1	48	4	44	1	28
SmA	Sassafras loamy sand, 0 to 2 percent slopes.	18	IIs–4	23			1	48	2	44	2	30
SmB	Sassafras loamy sand, 2 to 5 percent slopes.	18	IIs–4	23			1	48	2	44	2	30
SmB2	Sassafras loamy sand, 2 to 5 percent slopes, moderately eroded.	19	IIs–4	23			1	48	2	44	2	30
SmC	Sassafras loamy sand, 5 to 10 percent slopes.	19	IIIe–33	24			2	48	2	44	2	30
SmC2	Sassafras loamy sand, 5 to 10 percent slopes, moderately eroded.	19	IIIe–33	24			2	48	2	44	2	30
SmC3	Sassafras loamy sand, 5 to 10 percent slopes, severely eroded.	19	IVe–5	25			2	48			2	30
SmD	Sassafras loamy sand, 10 to 15 percent slopes.	19	IVe–5	25			2	48			2	30
SmE	Sassafras loamy sand, 15 to 30 percent slopes.	19	VIe–2	25			3	48			2	30
SnA	Sassafras sandy loam, 0 to 2 percent slopes.	17	I–5	23			1	48	3	44	2	30
SnB	Sassafras sandy loam, 2 to 5 percent slopes.	17	IIe–5	23			1	48	3	44	2	30
SnB2	Sassafras sandy loam, 2 to 5 percent slopes, moderately eroded.	17	IIe–5	23			1	48	3	44	2	30
SnB3	Sassafras sandy loam, 2 to 5 percent slopes, severely eroded.	17	IIIe–5	24			1	48			2	30
SnC	Sassafras sandy loam, 5 to 10 percent slopes.	17	IIIe–5	24			2	48	3	44	2	30
SnC2	Sassafras sandy loam, 5 to 10 percent slopes, moderately eroded.	17	IIIe–5	24			2	48	3	44	2	30
SnC3	Sassafras sandy loam, 5 to 10 percent slopes, severely eroded.	17	IVe–5	25			2	48			2	30
SnD	Sassafras sandy loam, 10 to 15 percent slopes.	17	IVe–5	25			2	48			2	30
SnD2	Sassafras sandy loam, 10 to 15 percent slopes, moderately eroded.	18	IVe–5	25			2	48			2	30
SnE	Sassafras sandy loam, 15 to 30 percent slopes.	18	VIe–2	25			3	48			2	30
SnF	Sassafras sandy loam, 30 to 60 percent slopes.	18	VIIe–2	25			3	48			2	30
SsA	Sassafras sandy loam, heavy substratum, 0 to 2 percent slopes.	18	I–5	23			1	48	3	44	2	30
SsB	Sassafras sandy loam, heavy substratum, 2 to 5 percent slopes.	18	IIe–5	23			1	48	3	44	2	30
Sw	Swamp	19	VIIw–1	25			8	48				
Tm	Tidal marsh	19	VIIIw–1	25			8	48				
WdA	Woodstown loam, 0 to 2 percent slopes.	20	IIw–1	23	2A	46	7	48	4	44	1	28
WdB2	Woodstown loam, 2 to 5 percent slopes, moderately eroded.	20	IIe–16	23	2A	46	7	48	4	44	1	28
WoA	Woodstown sandy loam, 0 to 2 percent slopes.	20	IIw–5	23	2B	46	7	48	3	44	2	30
WoB	Woodstown sandy loam, 2 to 5 percent slopes.	20	IIe–36	23	2B	46	7	48	3	44	2	30
WoB2	Woodstown sandy loam, 2 to 5 percent slopes, moderately eroded.	20	IIe–36	23	2B	46	7	48	3	44	2	30
WoC	Woodstown sandy loam, 5 to 10 percent slopes.	20	IIIe–36	24			7	48	3	44	2	30

681-789 O - 64 (Face blank p. 54)

This map is one of a set compiled in 1962 as a part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Maryland Agricultural Experiment Station.

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

2

N

(Joins sheet 3)

(Joins sheet 4)

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

CAROLINE COUNTY, MARYLAND — SHEET NUMBER 3

(Joins sheet 1)

SmC2

3

N

QUEEN ANNES COUNTY

Kan-

Marydel

WoA

Po

WoA

(Joins sheet 2)

SnB

SmB2

(Joins sheet 5)

WoB2 LaB

SmB2 SmC2 WoB2

SmB2 WdAWoA SnA

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

This map is one of a set compiled in 1962 as a part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Maryland Agricultural Experiment Station

CAROLINE COUNTY, MARYLAND — SHEET NUMBER 4

CAROLINE COUNTY, MARYLAND — SHEET NUMBER 5

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

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CAROLINE COUNTY, MARYLAND — SHEET NUMBER 6

6

N

(Joins sheet 4)

Bridgetown

Branch

QUEEN ANNES COUNTY

Mason

ST GERTRUDE ACADEMY

Oakland

(Joins sheet 7)

(Joins sheet 9)

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

CAROLINE COUNTY, MARYLAND — SHEET NUMBER 7

(Joins sheet 4) | (Joins sheet 5)

7

N

Goldsboro

Lockerman Church

Ps

GaB

WoA

GaB

GaB

GaF

GaA

(Joins sheet 6)

(Joins sheet 8)

(Joins sheet 10)

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

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(8)

N

SnB2

(Joins sheet 5)

GaA

SnA

Ek

(Joins sheet 7)

Sw

Sw

GaF

(Joins sheet 11)

W6B2

Hoftank

Ervings Chapel

Three Corners

Sewell Mill

KENT COUNTY

DELAWARE

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

(Joins sheet 6)

9

N

(Joins sheet 10)

(Joins sheet 12)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

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10

(Joins sheet 7)

N

Greensboro

Boonsboro

(Joins sheet 9)

(Joins sheet 11)

(Joins sheet 13)

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 14)

N

Four Corners

Whiteleysburg

DELAWARE

Branch

SnB2

WoB2

SmB

ShB

SnA

Mt

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

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(12)

N

(Joins sheet 9)

WoA

SnB2

(Joins sheet 13)

SaB2

Fs

PENNSYLVANIA

TUCKAHOE

QUEEN ANNES COUNTY

TRAPPE

TALBOT COUNTY

BALTIMORE AND EASTERN

Hillsboro

Thomas Town

Allan Church

Downes

312

404

SnB2 WoA

(Joins sheet 15)

0 1 Mile

Scale 1: 20 000

0 5000 Feet

(Joins sheet 10)

13

N

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

14

N

SnA SnB2 *(Joins sheet 11)* Fs

SnB2

(Joins sheet 13)

SaB2 Fs

Ex

(Joins sheet 17)

Mt

KENT COUNTY

DELAWARE

Chapel Branch

Branch

Union Church

Burrsville

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

CAROLINE COUNTY, MARYLAND — SHEET NUMBER 15

SnB2 WdA SaB2 WdA SnD2 SnB2 WoA

(Joins sheet 12)

15

N

(Joins sheet 16)

(Joins sheet 18)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

16

N

(Joins sheet 13)

(Joins sheet 15)

(Joins sheet 17)

(Joins sheet 19)

West Denton

Lockerman School

DENTON
(county seat)

Anthony

BALTIMORE

EASTERN

CHOPTANK RIVER

WATTS CREEK

PEALIQUOR LANDING

Watts Creek

Hunting Run

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

CAROLINE COUNTY, MARYLAND — SHEET NUMBER 17

17

N

(Joins sheet 14)

(Joins sheet 16)

(Joins sheet 20)

SnB2

COUNTY FARM

Burrsville

Hobbs

Ringgolds Green

0 ½ 1 Mile

Scale 1: 20 000

0 5000 Feet

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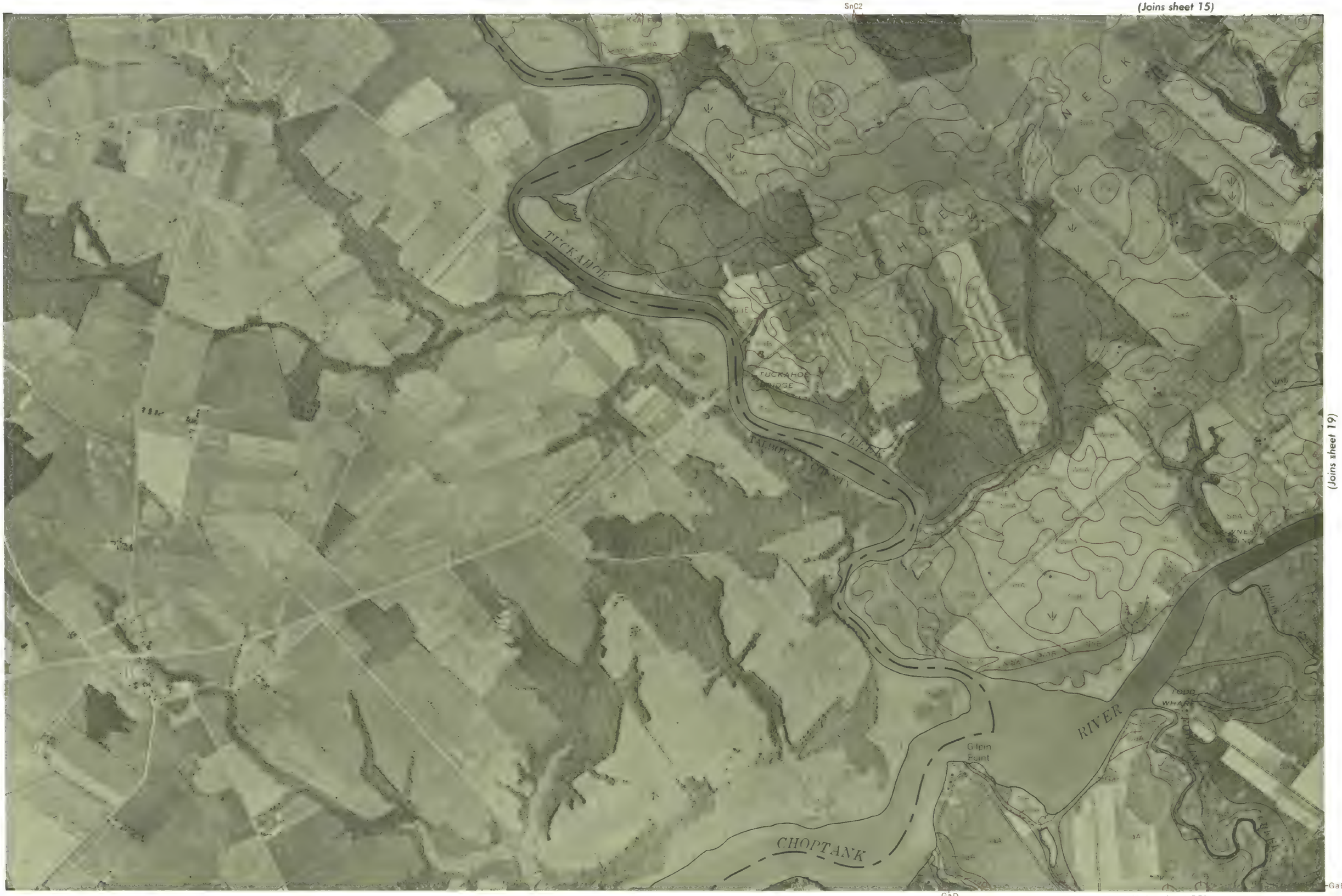
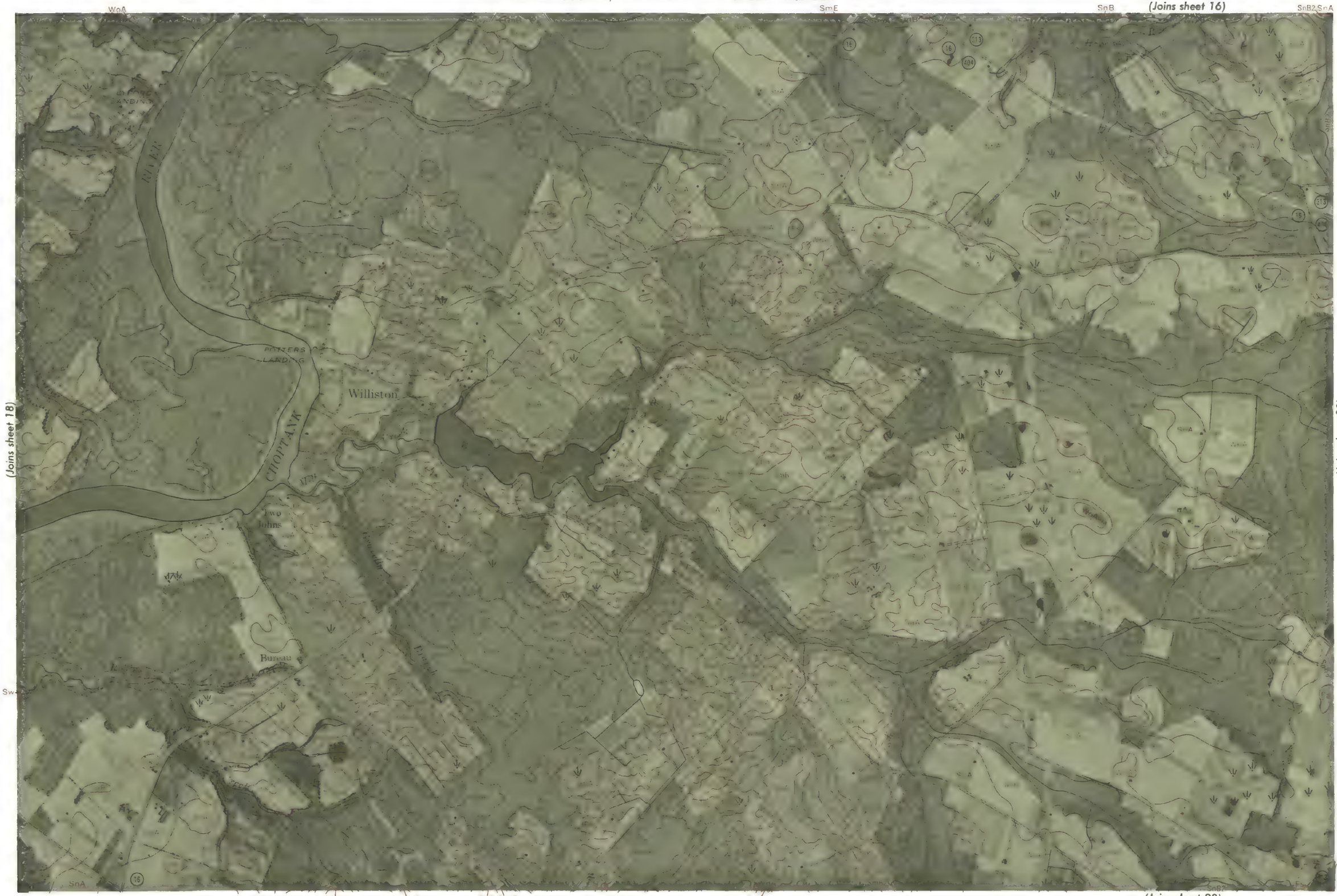
(18)

N



0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 22)



This map is one of a set compiled in 1962 as a part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Maryland Agricultural Experiment Station

(Joins sheet 17)

20

N

(Joins sheet 19)

(Joins sheet 24)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

21

N

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

22

(Joins sheet 18)

Scale 1: 20 000

0 ½ 1 Mile

0 5000 Feet

(Joins sheet 19)

23

N

Concord

Opossum Hill

SnA

SmB

GaA
GaB

(Joins sheet 22)

(Joins sheet 24)

SnB2

SmC2

WoB2

(Joins sheet 27)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

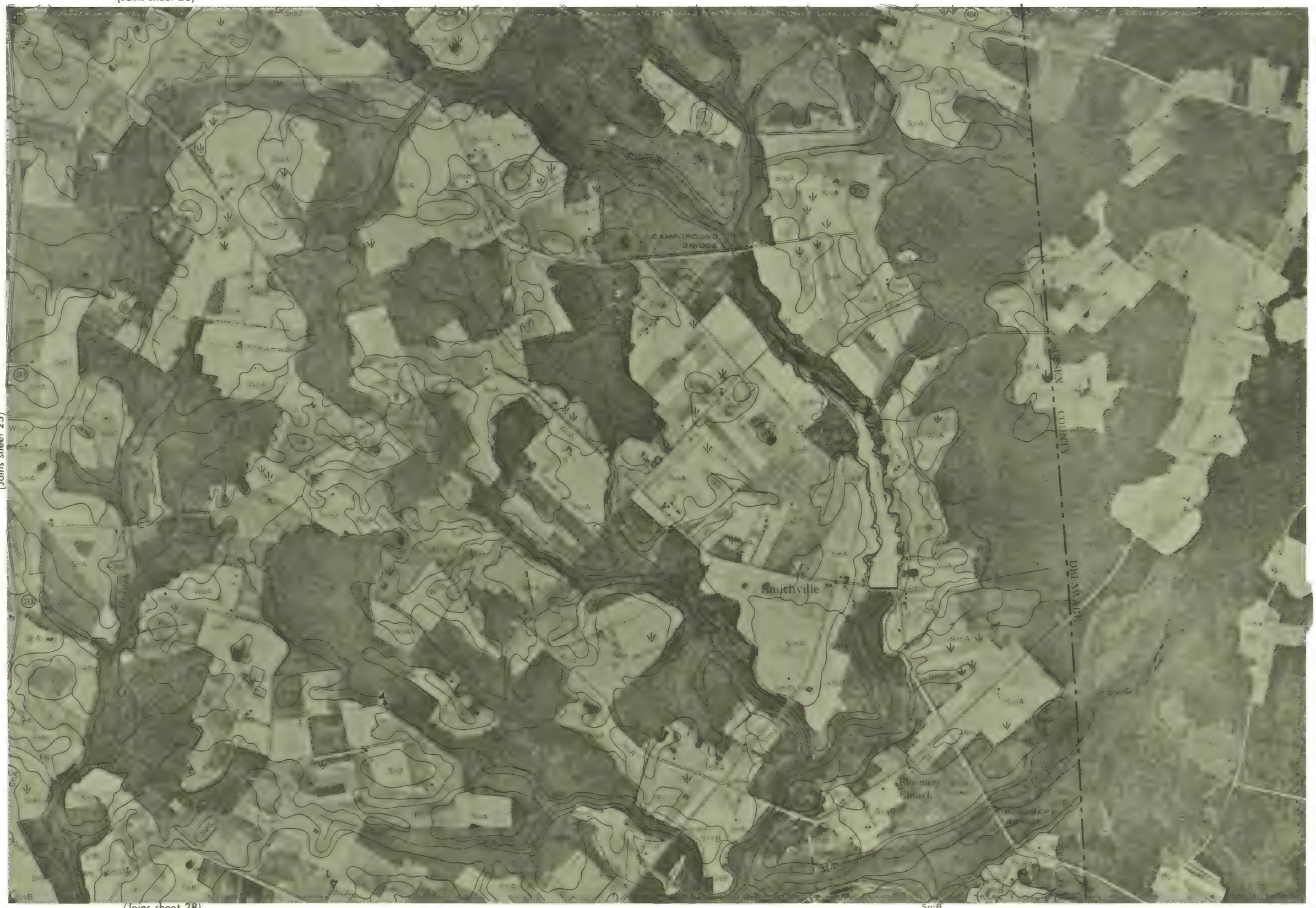
This survey was started in 1962 as a part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Maryland Agricultural Experiment Station

24

(Joins sheet 20)

N

(Joins sheet 23)



(Joins sheet 28)

0 ½ 1 Mile

Scale 1 20 000

0 5000 Feet

(Joins sheet 21)

25

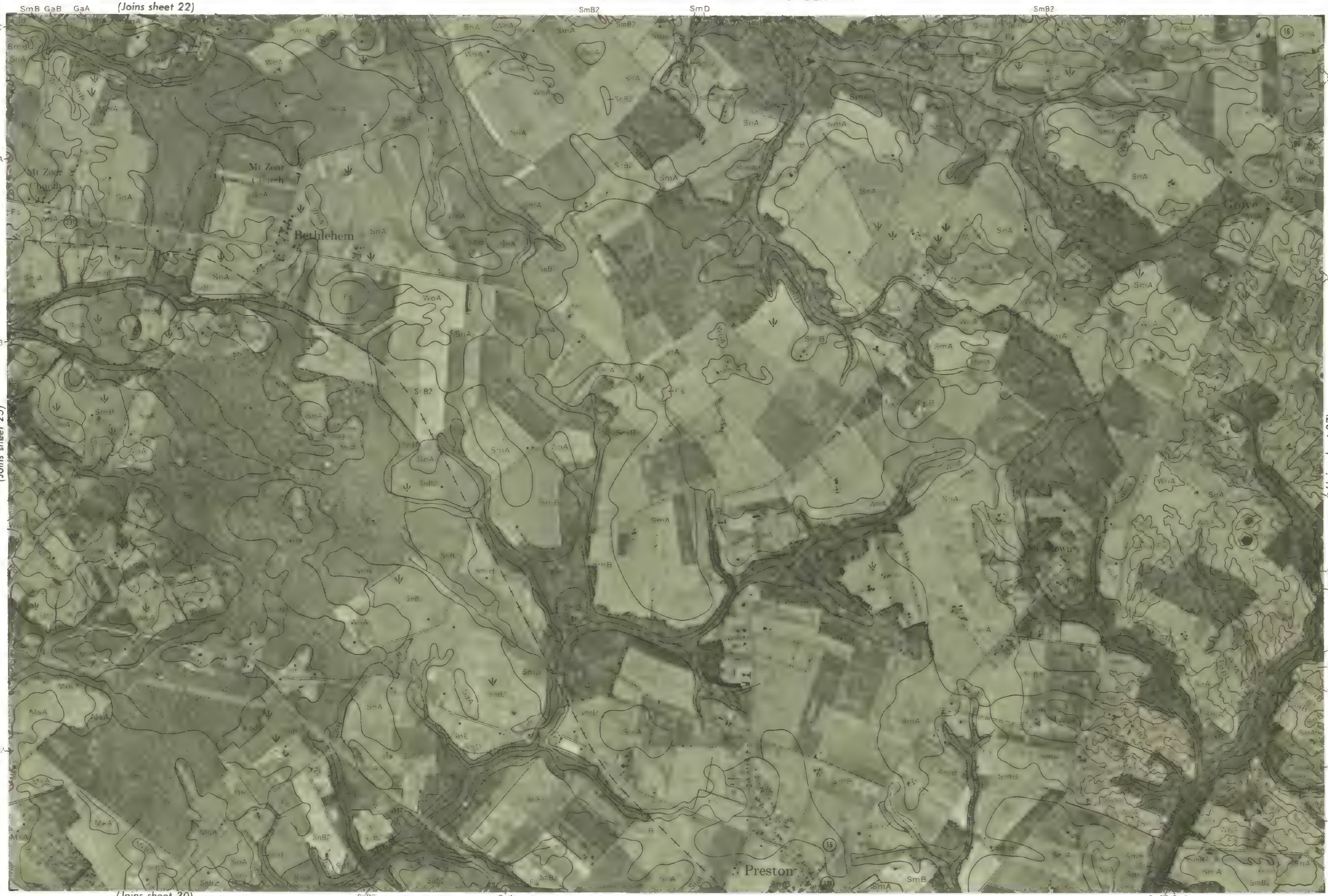
N

(Joins sheet 26)

(Joins sheet 29)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

This map, s one of a set compiled in 1962 as a part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Maryland Agriculture Experiment Station


26
(Joins sheet 22)
SmB GaB GaA
SmC
N
KsA
Mt Zoar Church
Bethlehem
SmB2
SmD
SnA
WoA
SnC3
(Joins sheet 25)
MkB2
SmE
Fs
Preston
(Joins sheet 30)
(Joins sheet 27)
SmA
SnB
Mt
SmB2 GaC
0
½
1 Mile
Scale 1: 20 000
0
5000 Feet

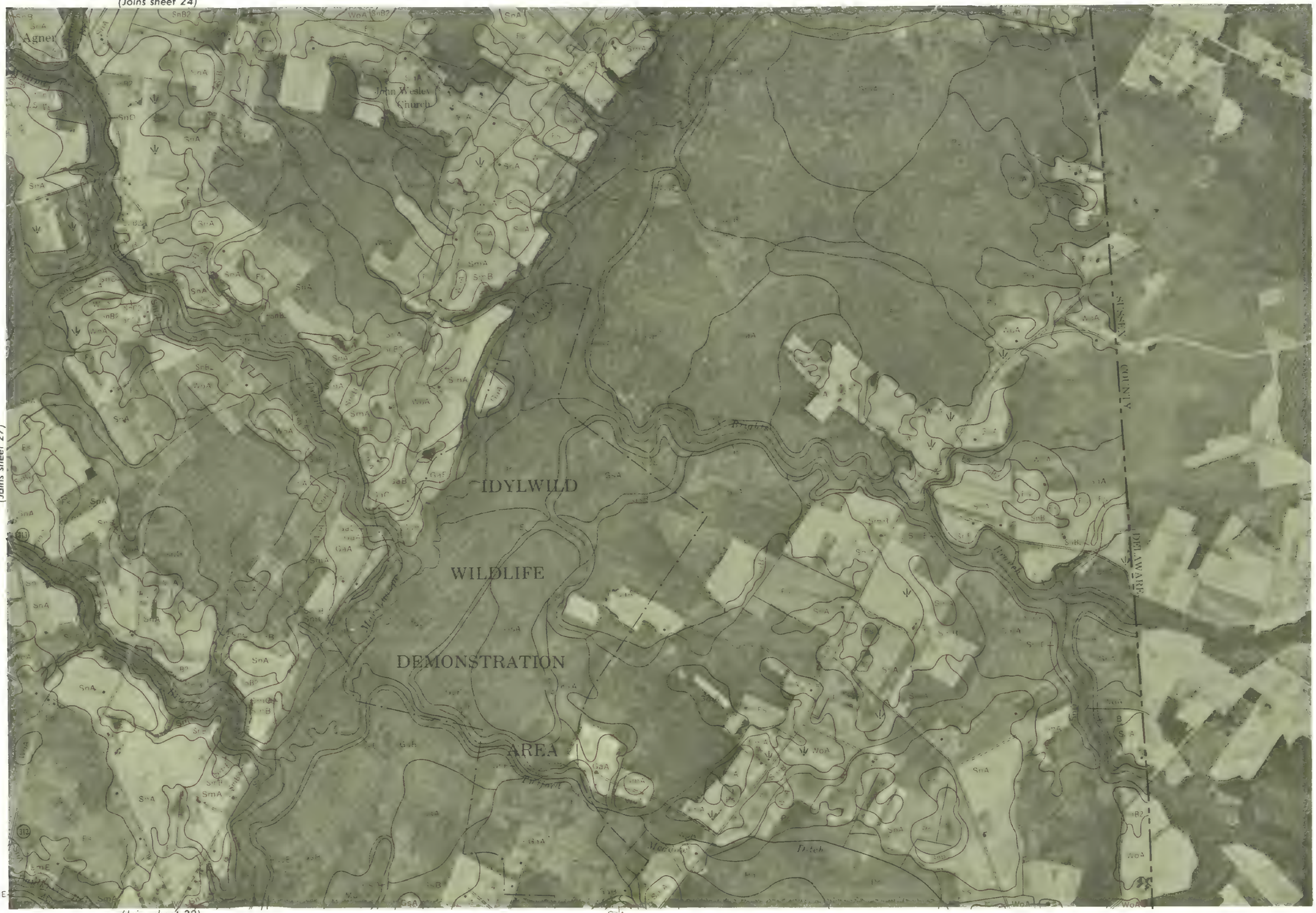
CAROLINE COUNTY, MARYLAND — SHEET NUMBER 27

This map is one of a set compiled in 1962 as a part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Maryland Agricultural Experiment Station.

28

(Joins sheet 24)

N



(Joins sheet 27)

(Joins sheet 32)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

(Joins sheet 25)

29

(Joins sheet 30)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

30

(Joins sheet 26)

N

(Joins sheet 29)

(Joins sheet 31)

Preston

Linchester

Choptank

MARSH

CREEK

HUNTING

DORCHESTER COUNTY

CHOPTANK RIVER

TALBOT COUNTY

BALTIMORE AND EASTERN

DORCHESTER COUNTY

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

CAROLINE COUNTY, MARYLAND — SHEET NUMBER 31

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet

(Joins sheet 28)

(Joins sheet 31)

(Joins sheet 33)

CAROLINE COUNTY, MARYLAND — SHEET NUMBER 33

(33)

(Joins sheet 32)

0 ½ 1 Mile Scale 1: 20 000 0 5000 Feet